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Exploring the role of vertebrates and their by-products in human and veterinary remedies: A comprehensive review

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Abstract
Background: Traditional knowledge refers to the knowledge, innovations and practices of indigenous peoples. Animals and plants have been a vital source of both curative and preventive medicinal therapy preparations for human beings.
Main body of the abstract: The aim of present review is summarising the traditional uses of vertebrates and their by-products in human and veterinary remedies. Animal species uses as raw and their derived products also used for treating various types of diseases. Different traditional uses of vertebrates and their bi-product by the local peoples in many states of India are used for treating human and animal diseases. For medicinal purposes 40% mammals, 7% birds, 11% reptiles, 8% fishes and 2% amphibians are used in different parts of India. In Kerala, about 69 animal species and their bi-product are used for treating human and veterinary diseases. Similarly, about 69 animals in Theni district Tamil Nadu, 18 in Madhya Pradesh, 25 in Tripura,44 in Assam is used for treating human and veterinary diseases. Thus, the main aim of this review is to summarise the traditional uses of animals and their derived products for medicinal purposes.
Short conclusion: The present review concluded that the number of Vertebrates and their by-products are used in traditional remedies for treating human and veterinary aliments in across various region in India. There are 270 reported uses for about 109 animals in traditional medicine across various regions of India

Keywords: traditional knowledge, zootherapy, natural remedies, fishes, birds and mammals

Introduction

The knowledge of local people living in a particular place or community gained from their life experiences which they use to solve their daily life problems is known as Traditional knowledge. Indian standard healing systems are among the most well-known in the globe. It is a well-known notion that folk medicinal systems have always played a critical role in servicing the requirements of the international health care system (Ravishankar and Shukla, 2007;) [32]. The populace is educated in the utilisation of natural ecosystems for their immediate living, encompassing food, medicine, and other necessities. (Chellappandian *et al.,* 2014) [10]. Different cultures have used biodiversity as a therapeutic tool since the dawn of humanity (Gupta *et al.,* 2003) [15]. India is incredibly diverse in terms of its flora, fauna, and civilization, and many immigrant communities worldwide reliant on the folk medicinal system for their basic healthcare (Borah and Prasad, 2017) [9]. India is gifted with immense faunal and floral biodiversity, because of the extreme variation in geographical and climatic conditions prevailing in the country. There are about 81000 species of animals (Jaroli *et al.,* 2010) [18]. Ethnobiology is the consideration when dealing actively with the life forms in their environs. A subset of anthropology entitled ethnozoology researches how individuals and creatures have intertwined throughout history. As of ancient times, a significant of progress has been made in India to safeguard the old traditions of existing or nourishing, quite in addition to the general environment and its natural resources. As nothing more than a result, the indigenous people have been utilising varied wild animal resources or their elements in therapeutic approaches. (Rao *et al.,* 2015; Kumar *et al.,* 2018; Kumar *et al.,* 2019; Kumar *et al.,* 2023) [31]. According to world health organization, up to 80% of the world's more than 6 billion occupants rely mostly on animal and plant-based cures for medical issues (Mahawar and Jaroli, 2008) [26]. There is confirmation that humans are accustomed to using plants and animals for food, garments, medicine, etc. Zootherapy is a crucial aspect of ethnozoology; it is the obligation to treat human illnesses with drugs that are either directly derived from animals or borrowed from them. The core features of several traditional systems are zootherapeutic resources. Animals, their parts, and their products have long been included in the list of therapeutic drugs administered by numerous cultures. Since the earliest days of time, India has made enormous strides in the fields of zootherapy and traditional medicine, which are documented extensively in texts like the Ayurveda and the Charaka Samhita. In Ayurvedic system many of animals are described which includes 24 insects, 16 reptiles, 21 fishes, 41 aves and 41 mammals. In India today, a broad selection of ethnic communities and tribes engage animals and animal products to cure human and animal maladies. The members of these communities are well versed about the animals and their medical characteristics, and they also offer a huge amount of information concerning the use of animals and their by-products as medicine. There are numerous tribal and ethnic communities strewn throughout India. Because they live in remote areas without significant exposure to hospitals or other modern facilities, the bulk of rural, tribal, and ethnic populations are completely reliant on their local traditional medical systems for their healthcare. This understanding is passed down verbally from generation to generation (Jaroli *et al.,* 2010) [18]. In modern societies, zootherapy constitutes an important alternative among many other known therapies practiced worldwide. Research

interest and activities in the areas of ethnobiology and ethnomedicine have increased tremendously in the last decade. Since the inception of the disciplines, scientific research in ethnobiology and ethnomedicine has made important contributions to understanding traditional subsistence and medical knowledge and practice. We can find that in our rural people still use various animal products and by-products for cure of various diseases. Various products derived from animals such as honey from honey bees used as medicinal drug, urine of cows, goats etc. used as restorative (Mahawar and Jaroli, 2007) [25]. Milk of cattle have many health benefits, many other animal derived products and parts of animals such as blood, skin, spines, bones, feathers, ash of shell, flesh, excreta, dung, brain, fat used by local people and different communities belongs to different places in India as traditional remedies for treatment of human and veterinary ailments. Due to the existing allopathic treatment's adverse effects and lack of a solution for many ailments, there has been a sort of dissatisfaction with it, bringing all this knowledge to the forefront again. As an outcome, people are looking for conventional medicines for maladies. But because of modernisation, this old knowledge is rapidly dwindling in India. In order to prevent the loss of traditional cultures, it is vital that all ethnobiological knowledge from the numerous cultural populations be thoroughly inspected and preserved (Trivedi, 2002) [40]. When compared to plants, inquiry on the biomedical values of living creatures and their biological parts has been neglected (Solavan *et al.,* 2004) [36]. Approximately 15 to 20% of the traditional Indian medicine used in India is derived from animals (Unnikrisnhan, 1998;) [41]. From very ancient times herbal medicines used in India for curing diseases by our traditional healers. Many people still used these remedies to cure diseases, in many places in India where traditional knowledge is still preserved by new generation of traditional healers, which is transmitted orally by parents to their children and so on. Thus, from generation to generation this local knowledge is used by people for their need and for healing purposes. This knowledge is very effective and beneficial for future development in field of health care system of India and also very low of cost. As we all know that chemically prepared medicines and drugs have many side defects on our body functioning. These traditional remedies do not cause any harm to our body. Traditional medical practises get their crude ingredients from an assortment of sources, namely medicinal plants, minerals, animals, and marine species. (Biswas and Mukherjee, 2003) [8]. Even as far back as the ancient Mesopotamian, Assyrian, and Babylonian civilizations, the customary use of animals or their products for therapeutic purposes has been recorded throughout history in written documents such as papyri, archives, and various classical medical compendiums (Lev, 2013; Sharma *et al.,* 2018; Sharma *et al.,* 2019; Sharma *et al.,* 2020; Sharma *et al.,* 2021; Sharma *et al.,* 2022) [24]. Hippocrates (Greece, V–IV century BC), Dioscorides (Greek physician born in Anatolia, 1st century AD), Avicenna (Persia, X–XI century AD), and Ibn al Baitar are some of the most well-known authors of medical treatises that included animal examples (Andalusia, XII-XIII century AD). Animals make up about 10% of the medicinal samples found in the major classical literature. (De vose, 2010). In the old days, ethnobotanical research and surveys geared at researching medicinal plants have gained tremendous more attention from researchers than zootherapeutic activities (Vijaykumar *et al*., 2015). Despite the fact that traditionally countless animal-based pharmaceuticals are delivered hall over the world, there has been a substantial amount of effort put into the registration, use, diagnosis, and authentication of traditional plant-based medicines (Pushpangdan, 1990; Neto, 1999) [30]. Zootherapy is a serve as a competitive advantage to the many other well-known cures used across the globe in contemporary society. Various parts of wild and cultivated animals, including their hooves, skin, bones, feathers, and tusks, are crucial components in the creation of remedial, precautionary, and redemptive medications. 11.1% of the 252 active compounds chosen by the World Health Organization are derived from plants, and 8.7% are derived from animals. In America, 27 of such 150 taking medicines are obtained from animals (Mahawar and Jaroli, 2008; Thakur *et al.,* 2022; Tomar *et al.,* 2022) [18]. Upwards of 1500 life forms have been acknowledged to have some therapeutic effects in Traditional Chinese Medicine (Mahawar and Jaroli, 2008) [18]. In India, between 15 and 20% of ayurvedic medicine is sourced from animals (Unnikrishnan, 1998). 200 medications are used in the Unani medical system. (Sharma, 1996). 584 animals in 13 systematic classifications in Latin America were recognised as having conventional rehabilitation healing uses (Alves and Alves, 2011) [1]. Per the reports, 283 animal species are employed in Brazil to treat a variety of illnesses. (Alves *et al.,* 2007). Argentina uses 72 different animal groups (Martinez, 2013) [4]. Israel actively uses 20 animal species as folk remedies (Lev and Amar, 2000) [23]. The Tamang people of Nepal have learned that 11 animal species and their by-products are effective in curing disease and are utilised as folkloric medicine (Tamang, 2003) [38]. 30 animal species are known to exist in the Kingdom of Jordan, and it was discovered that some of their products were used to make alternative remedies (Lev and Amar, 2002) [24]. This review compiles information on all vertebrate species, including Pisces, Amphibia, reptile, Aves and Mammals used as Traditional remedies and folk remedies for healing human and animal diseases.

Main Text .

Use of animals and their by-products for treating human diseases

Many years of observation and experimentation have provided medical knowledge in the use of natural products (Alves and Rosa, 2013) [4]. Around 60% of commercially available drugs are based on bioactive compounds extracted from natural resources traditionally used by various indigenous culture around the globe (Cragg and Newman, 2013). Since ancient times, countless diverse societies have used animals and their things produced from their various organs as medications. 99 compounds of animal origin that were utilised medicinally during that lengthy period were unearthed from ongoing examination into the phenomenon of zootherapy in the Levant from early mediaeval to modern mainstream medicine. From the early Muslim era (10th century) through the late Ottoman era, 52 animal experts and products were recognized as being used (19th century). In the 20th century, 77 were noted as being utilised (Lev, 2003) [21]. The topic of zootherapy is typified by both a vast global range and exceedingly huge historical antecedents. Animal-based remedies have been used since classical era, while several authors have proven. (Anageletti *et al*., 1992;

Weiss, 1947). Many historical sources dealing with medicine, show that animals and their parts, and their products were used for medicine. Evidence on such practises have been revealed in ancient civilizations including Egypt and Mesopotamia, that had an imprint on the several tribes that later evolved in the Levant (Lev, 2006) [22]. Ancient Egyptian ancient writings highlight the need for a variety of biological commodities for healing, notably cow's milk, bee honey, lizard blood, swallow's liver, bat limbs, oakmoss made from whale sperm, and musk deer glands (Estes, 1989; Stetter, 1993) [14, 37]. Mesoamerican artefacts, mostly Assyrian and Babylonian, depict the use of fish oil, beeswax, honey, turtle shells, goat skin, gazelle, deer, and sheep sinew, as well as bird droppings and animal fat. The glands of the musk deer were administered in ancient China, alongside a range of other compounds derived from animal (Kremers, 1976) [20]. The Hindu faith in India has long recognised the advantages of cow by-products and has employed them as traditional treatments for illness. (Simoons, 1974) [35].

Use of animals and their by-product for treating veterinary diseases

The practice of using animals and animal-based products for detecting different veterinary maladies was also highlighted by respondents, in addition to treating human diseases. There are about 11 different animal species utilised to cure different veterinary maladies, encompassing 8 wild animal species and fish. In majority of such cases, blood was most commonly used product for treating body pain, arthritis, and healing the fractured bones of animals (Gupta *et al.,* 2003) [15].

Fish species used for treatment of human and veterinary diseases

Out of 18 animals reported in Chhindwara district Madhya Pradesh, only 1 fish species *Labeo rohita* found (Bagde and Jain, 2017) [6]. Ethnozoological study by traditional healers and indigenous inhabitants of Gibbon Wildlife Sanctuary, Assam reported fishes (16.7%) (Borah and Prasad, 2017) [9]. Traditional healers of Theni district, Tamil nadu reported fishes (10.29%) (Chellappandian *et al.,* 2014) [10]. Tripura reported 8% fishes among all vertebrates (Das, 2015). Shoka tribes of district Pithoragarh Uttaranchal reports 2 fishes out of 38 animals (Negi and Palyal, 2007). Silent valley of Kerala reported 4% Actinopterygii (Vijaykumar *et al.,* 2014).

For human diseases

One fish species reported by Ao Tribe of Nagaland i.e *Amphipnous cuchia* used for treating Asthma (Kakati *et al*., 2006) [19]. Tribes and rurals of Chhindwara District of Madhya Pradesh found medicinal use of one fish species i.e *Labeo rohita* for treating rheumatism. Fish species such as *Zygaena blochii, Hippocampus cuda* etc. reported in District Kachchh Gujarat (Gupta *et al*., 2003) [15]. *Channa punctatus* reported in Tripura (Das, 2015). Species of fish like *Anguilla bengalensis, Harpadon nehereus, labeo rohita* reported in Silent valley of Kerala for treating cough, lactation, urinary obstruction respectively (Vijaykumar *et al.,* 2014). In Tamil Nadu fish species such as *Stolephorus spp., Lepidocephalichthys thermalis*, C*hannidae* are used (Vijaykumar, 2015). Sahara tribe of Rajasthan used *Labeo rohita* for urinary problems (Mahawar and Jaroli, 2007) [25]. In Uttaranchal *Tor putitora, Schizothorax richardsoni* are used (Negi and Palyal, 2007). In Arunachal Pradesh *Mystus seenghala, Channa punctatus, Anabas testidunus* etc. are reported (Chinlampianga *et al.,* 2013) [11]. In Mizoram *Cyprinus carpio* and *Bagarius bagarius* used (Chinlampianga *et al.,* 2013) [11]. Various types of fish and their bi-products are used for treating various diseases in human. Traditionally at least 30-31 fish species are used (Table 1).

For veterinary diseases

For treating animals only 2 fish species are reported such as *Hippocampus cuda* and hippocampus spp. in Kachchh Gujarat. Animal whole body and brain is used for treating stomach pain and urinary problems. Fish species used to treat veterinary diseases are shown in (Table 2).

Amphibia species used for treatment of human and veterinary diseases

3%, species found in Kerala (Vijaykumar *et al*., 2014). 4.34% in Tamil Nadu (Vijaykumar *et al.,* 2015). 4% in Tripura (Das, 2015). 1 species reported in Uttaranchal (Negi and Palyal, 2007). Similarly, 1 species of amphibia reported in Madhya Pradesh (Bagde and Jain, 2017) [6] and 1 in Nagaland (Kakati *et al.,* 2006). 7.1% amphibia species reported in Assam (Borah and Prasad, 2017). No species of amphibia found in Gujarat for treating human and veterinary ailments (Gupta *et al.,* 2003) [15].

For human diseases

Use of 1 *Rana sp.* Reported in Nagaland (Kakati *et al*, 2006) [19]. In Assam P*olypedates leucomystax, Bufo sp*., *Ranna sp*., reported (Borah and Prasad, 2017). In Kerala *Euphlyctis hexadactylus* and *Rana clamitans* species reported (Vijaykumar *et al*., 2014). *Rana Tigrina* species used in Uttaranchal (Negi and palyal, 2007*). Rana sp*. and *Bufo sp*. reported in Theni district of Tamil Naidu (Chellappandian *et al.,* 2014). Only *Ranna sp*. found in Madhya Pradesh (Bagde and Jain, 2017) [6]. *Rana tigrina* species used in Tripura (Das, 2015). *Rana tigrina*, *Nanorana liebigii*, *Amolops himalayans* these 3 species used in Andhra Pradesh (Benarjee *et al.,* 2010). *Bufo melanostictus* reported in Mizoram (Chinlampianga *et al*., 2013) [11]. Rana tigrina species also reported in West Bengal (Ghosh *et al.,* 2013). Various types of amphibia and their bi-products are used for treating various diseases in human. Traditionally at least 10 -15 amphibia species are used.

Reptile species used for treatment of human and veterinary diseases

6.53 % reptiles reported in Tamilnadu (Vijaykumar *et al.,* 2015). 4% reptile species found to be used as medicinal purposes in Tripura (Das, 2015). 5 reptiles species used in Uttaranchal (Negi and Palyal, 2007). 11.9% reptiles reported in Assam (Borah and Prasad, 2017) [9]. 3 reptiles fauna used in Madhya Pradesh (Bagde and Jain, 2017) [6]. 10% reptiles used in Kerala (Vijaykumar *et al*., 2014). 6.53% reported in Tamil Nadu (Vijaykumar *et al.*, 2015). 2 species found in Nagaland (Kakati *et al.*, 2006) [19]. 1 reptile (4%) species reported in Tripura (Das, 2015). 3 species found in Kachchh Gujarat (Gupta *et al.,* 2003) [15].

For human diseases

In Madhya Pradesh *Varanus bengalensis*, *Naja naja*, *Testudo spp*. used (Bagde and Jain, 2017) [6]. *Kachuga tentoria* found in Rajastham (Mahawar and Jaroli, 2007) [25]. In Tamil Nadu species found are *Calotes versicolor*, *Serpentes*, Ptyas mucosa etc (Chellappandian *et al.*, 2014) [10]. In Assam *Ptyas mucosa*, *Varanus bengalensis* etc. reported (Borah and Prasad, 2017) [9]. Various types of reptiles and their bi-products are used for treating various diseases in human. Traditionally at least 30- 35 reptile species are used.

For veterinary diseases

Calotes versicolor used in Andhra Pradesh (Benarjee *et al.*, 2010) and *Lissemys punctatus* in Gujarat (Gupta *et al.*, 2003) [15] for treating animals and humans. The reptile species used to treat veterinary diseases.

Aves species used for treatment of human and animal diseases

Tripura reported 3 birds (12%) (Das, 2015). 23.92% aves found in Kerala (Vijaykumar *et al.*, 2015) [42]. 8 species used in Gujarat (Gupta *et al.*, 2003) [15]. 3 birds (12%) in Tripura (Das, 2015). 33.827 birds in Tamil Naidu (Chellappandian *et al*., 2014) [10]. 7 in Nagaland (Kakati *et al.*, 2006) [19].
3 in Madhya Pradesh (Bagde and Jain, 2017) [6]. No bird's species reported in Assam (Borah and Prasad, 2017) [9]. 6 species used in Uttaranchal (Negi and Palyal, 2007).

For human diseases

In Uttaranchal some of the species reported are *Columba Livia*, *Anas platyrhynchos* etc. (Negi and Palyal, 2007). In Kerala *Columba livia*, *Corvus macrorhynchos* etc. (Vijaykumar *et al.*, 2014). In Churu *Passer domesticus*, *Pavo cristatus* etc. (Rao *et al.*, 2015) [31]. In Gujarat *Passer domesticus, Pavo cristatus* etc. used (Gupta *et al*., 2003) [15]. In Rajasthan *Columba livia*, *Passer domestica* used (Mahawar and Jaroli, 2007) [25]. In Sikkim *Pavo cristatus*, *Corvus macrorhynchos* etc. used (Dhakal *et al.*, 2019). In Orissa *Buceros bicormis* and *pavo cristatus* used (Mishra *et al*., 2011). Various types of aves and their bi-products are used for treating various diseases in human. Traditionally at least 39- 40 aves species.

For veterinary diseases

Only one bird species *Gallus domesticus* reported in Gujarat (Gupta *et al.*, 2003) [15]. Birds' species used to treat veterinary diseases.

Mammal species used for treatment of human and veterinary diseases

Kerala reported 30.43% mammals (Vijaykumar *et al.*, 2015) [42]. Tripura reported 11 mammals (44%) (Das, 2015). 23.8% in Assam (Borah and Prasad, 2017) [9]. 5 in Madhya Pradesh (Bagde and Jain, 2017) [6]. 12 mammals reported in Nagaland (Kakati *et al.*, 2006) [19]. 33.8% mammals used in Tamil Nadu (Chellappandian *et al.*, 2014) [10]. 11 mammals (44%) reported in Tripura (Das, 2015). 16 mammal's species in Gujarat (Gupta *et al*., 2003) [15]. 29% mammals reported in Kerala (Vijaykumar *et al.*, 2014). 20 mammals reported in Uttaranchal (Negi and Palyal, 2007).

For human diseases

In Assam species reported are *Herpestes edwardsii*, *Bos indicus, Bubalus bubalus* etc. (Borah and Prasad, 2017) [9]. In Tamil Nadu species such as *Pteropus giganteus*, *Elephas maximus*, *Bos primigenius taurus* etc. reported (Vijaykumar *et al.*, 2015) [42]. In Gujarat *Camelus dromedarius*, *bubalus spp.*, *Bos indicus*, *Canis familiaris* etc. used (Gupta *et al.*, 2003) [15]. In Kerala some of species used are *Bubalus bubalus, canis aureus, Capra indicus, Rusa unicolor* etc. (Vijaykumar *et al.*, 2014). In Uttaranchal species reported are *Equus cabalus, Panthera Pardus, Rattus rattus, Maccaca mulatta* etc. (Negi and Palyal, 2007). In Andhra Pradesh reported species are *Equas equas*, *Panthera pardus*, *Bos bubalus* etc. (Benarjee *et al.*, 2010). In Ladakh species used are *Ursus arctos, Vulpes vulpes, Lutra lutra, Lynx lynx* etc. (Haq *et al*., 2020) [17]. In Sikkim recorded species are *Panthera tigris, Canis aureus, Vulpes vulpes* etc. (Dhakal *et al.*, 2019). Various types of mammals and their bi-products are used for treating various diseases in human. Traditionally at least 40- 50 mammals' species are used.

For veterinary diseases

In Gujarat 7 mammals species reported which are *Hystrix indica*, *Bubalus* spp., *Camelus dromedarius*, *Capra indicus*, *Equus hemionus*, *Paraechinus microlapus*, *Cervus unicolor*. Mammals used to treat veterinary diseases.

Conclusion

This review summarizes different vertebrate's species used as traditional remedies in different states of India. These species used as raw or their derived products also used. In this review we come to know about different methods of preparation of these traditional remedies from animal's or their derived parts. 15 study publications by different authors on zootherapeutic investigations in India from 2000 to 2007 were used to compile the data. There are 270 reported uses for about 109 animals in traditional medicine across various regions of India. Of these, the treatment of respiratory system-related issues has been documented for the most animal species (42, 38.5%) and number of uses (50, 18.5%). 32 species (29.4%) are used in 34 (12.9%) uses to treat rheumatic and other pains. There are reports of 26 (9.9%) usage for 22 (20.2%) species to treat digestive issues. Mammalian species account for the majority of animals used as medicines. There have been reports of 44 mammals (or 40%), 18 birds (17%), 12 reptiles (11%), 9 fish (8%), and 2 amphibians (2%). Data from different published research papers on ethnozoological practices in Gujarat, Assam, Madhya Pradesh, Nagaland, Tripura, Tamil Nadu, Rajasthan, Uttaranchal, Kerala, Ladakh, Sikkim, Mizoram, Arunachal Pradesh, Orissa, Andhra Pradesh, West Bengal. Uses of Pisces, Amphibia, Reptiles, Aves, Mammals and their derived product as traditional remedies reported in different places of these states. Data on use of these species and their derived parts for treating animal's diseases is found only in two states Gujarat and Mizoram. No data found in case of Amphibian species for treating veterinary diseases. For human ailments data found on almost every state we mentioned above. Mammals are most commonly used for these practices. Use of amphibia species is least common. Many more unexplored data yet to be discovered in these states. Many states which are still unexplored one of which is Himachal Pradesh where is richness of faunal diversity and traditional knowledge, but no data or research work found here related to ethnozoological practices. It means in future many research work can be done on such places and to explore undiscover data or hidden knowledge.

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References

1. Alves R, Alves HN. The faunal drugstore: Animal-based remedies used in traditional medicines in Latin America. Journal of ethnobiology and ethnomedicine,2011:7(1)1-43.
2. Alves R, Rosa IL. Why study the use of animal products in traditional medicines. Journal of ethnobiology and ethnomedicine,2005:1(1):1-5.
3. Alves RR, Rosa, IL, Santana GG. The role of animal-derived remedies as complementary medicine in Brazil. BioScience, 2007, 57(11).
4. Alves, RRN, Rosa IL. Introduction: toward a plural approach to the study of medicinal animals. In Animals in Traditional Folk Medicine, Springer, Berlin, Heidelberg, 2013, 1-9.
5. Angeletti LR, Agrimi Umijert O, French D, Curia C, Mariani-Costantini R. Healing rituals and sacred serpents. The Lancet,1992:340(8813):223-225.
6. Bagde N, Jain S. Traditional and ethnozoological practices by tribes and rurals of Chhindwara district of Madhya Pradesh, India. World J Pharm Med Res,2017:3(8):263-268.
7. Benarjee G, Srikanth K, Ramu G, Ramulu KN. Ethnozoological study in a tropical wildlife sanctuary of Eturunagaram in the Warangal district, Andhra Pradesh, 2010.
8. Biswas TK, Mukherjee B. Plant Medicines of Indian Origin for Wound Healing Activity: A Review. International Journal of Lower Extremity Wounds,2003:2:25-39.
9. 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):1-13.
10. Chellappandian M, Pandikumar P, Mutheeswaran S, Paulraj MG, Prabakaran S, Duraipandiyan V, Al-Dhabi NA. Documentation and quantitative analysis of local ethnozoological knowledge among traditional healers of Theni district, Tamil Nadu, India. Journal of ethnopharmacology,2014:154(1):116-130.
11. Chinlampianga M, Singh RK, Shukla AC. Ethnozoological diversity of Northeast India: Empirical learning with traditional knowledge holders of Mizoram and Arunachal Pradesh. Indian Journal of Traditional Knowledge,2013:12(1):18-30.
12. Cragg GM, Newman DJ. Natural products: a continuing source of novel drug leads. Biochimica et Biophysica Acta (BBA)-General Subjects,2013:1830(6):3670-3695.
13. Das D. Ethno-zoological practices among tribal inhabitants in Khowai district of Tripura, north-east India. Journal of Global Bioscience,2015:4(9):3364-3372.
14. Estes J W. Egyptian healers. The Medical Skills of Ancient Egypt. Canton/MA, Science History Publications, 1989, 13-50.
15. Gupta L, Silori CS, Mistry N, Dixit AM. Use of Animals and Animal products in traditional health care systems in District Kachchh, Gujarat, 2003.
16. Hakal P, Chettri B, Lepcha S, Acharya AK. Rich yet undocumented ethnozoological practices of socio-culturally diverse indigenous communities of Sikkim Himalaya, India. Journal of ethnopharmacology,2020:249:112386.
17. Haq SM, Calixto ES, Yaqoob U, Ahmed R, Mahmoud AH, Bussmann RW, Abbasi, AM. Traditional usage of wild fauna among the local inhabitants of Ladakh, Trans-Himalayan Region. Animals,2020:10(12):2317.
18. Jaroli DÁ, Mahawar MM, Vyas N. An ethnozoological study in the adjoining areas of Mount Abu wildlife sanctuary, India. Journal of ethnobiology and ethnomedicine,2010:6(1):1-8.
19. Kakati LN, Ao B, Doulo V. Indigenous knowledge of zootherapeutic use of vertebrate origin by the Ao tribe of Nagaland. Journal of Human Ecology,2006:19(3):163-167.
20. Kremers E, Urdang G. History of Pharmacy. Revised by Glenn Sonnedecker, 1976.
21. Lev E. Traditional healing with animals (zootherapy): medieval to present-day Levantine practice. Journal of ethnopharmacology,2003:85(1):107-118.
22. Lev E. Healing with animals in the Levant from the 10th to the 18th century. Journal of ethnobiology and ethnomedicine,2006:2(1):1-9.
23. Lev E, Amar Z. Ethnopharmacological survey of traditional drugs sold in Israel at the end of the 20th century. Journal of ethnopharmacology,2000:72(1-2):191-2.
24. Lev E, Amar Z. Ethnopharmacological survey of traditional drugs sold in the Kingdom of Jordan. *Journal of Ethnopharmacology*,2002:82(2-3):131-145.
25. Mahawar MM, Jaroli DP. Traditional knowledge on zootherapeutic uses by the Saharia tribe of Rajasthan, India. Journal of Ethnobiology and Ethnomedicine,2007:3(1):1-6.
26. Mahawar MM, Jaroli DP. Traditional zootherapeutic studies in India: a review. Journal of Ethnobiology and Ethnomedicine,2008:4(1):1-12.
27. Martinez GJ. Use of fauna in the traditional medicine of native Toba (qom) from the Argentine Gran Chaco region: an ethnozoological and conservationist approach. Ethnobiology and conservation, 2013, 2.
28. Mishra N, Rout SD, Panda T. Ethno-zoological studies and medicinal values of Similipal Biosphere Reserve, Orissa, India. African Journal of Pharmacy and Pharmacology,2011:5(1):6-11.
29. Negi CS, Palyal VS. Traditional uses of animal and animal products in medicine and rituals by the Shoka Tribes of District Pithoragarh, Uttaranchal, India. Studies on Ethno-Medicine,2007:1(1):47-54.
30. Pushpangdan P. Animal and animal products in the local health traditions in India. In Proceeding IInd International Congress on Ethnobiology, 1990, 189.
31. Rao R, Lahiri SM, Rao V, Rao MS. An ethnomedicinal study in Tal Chhaper Area (Churu). Global journal for research analysis,2015:4:2277-8160.
32. Ravishankar B, Shukla VJ. Indian systems of medicine: a brief profile. African Journal of Traditional,

Complementary and Alternative Medicines,2007:4(3):319-337.
33. Ritter EK. Magical-expert (āšipu) and physician (asû): notes on two complementary professions in Babylonian medicine. Studies in honor of Benno Landsberger on his seventy-fifth birthday,1965:299-321.
34. Sharma M, Sharma AK, Thakur R, Sharma M. Dynamics of traditional information of medicinal plants from hilly Terrains of Ramban (J&K) India,2020:(4):1009-Indian Journal of Ecology 471013.
35. Simoons FJ. The purificatory role of the five products of the cow in Hinduism. Ecology of Food and Nutrition,1974:3(1):21-34.
36. Solavan A, Paulmurugan R, Wilsanand V, Sing AJ. Traditional therapeutic uses of animals among tribal population of Tamil Nadu. Indian Journal of Traditional Knowledge,2004:3:2206-207.
37. Stetter C. The Secret Medicine of the Pharaohs: Ancient Egyptian Medicine. Quintessence Publishing Company, 1993.
38. Tamang G. An ethnobiological study of the Tamang people. Our nature,2003:1(1):37-41.
39. Tomar, Sharma MP. Drugs of animal origin in Unani medicine: The need for scientific evaluation. Ethnobiology in Human Welfare, 1996, 206.
40. Trivedi PC. Ethnobotany: an overview. Ethnobotany edited by: Trivedi PC. Jaipur: Aavishkar publisher, 2002.
41. Unnikrisnhan PM. Animals in ayurveda. Amruth, 1998, 1-15.
42. Vijayakumar S, Prabhu S, Yabesh JM, Pragashraj R. A quantitative ethnozoological study of traditionally used animals in Pachamalai hills of Tamil Nadu, India. Journal of ethnopharmacology,2015:171:51-63.
43. Vijayakumar S, Yabesh JM, Prabhu S, Ayyanar M, Damodaran R. Ethnozoological study of animals used by traditional healers in Silent Valley of Kerala, India. Journal of ethnopharmacology,2015:162:296-305.
44. Vos PD. European Materia Medica in Historical Texts: Longevity of a Tradition and Implications for Future Use. Journal of Ethnopharmacology,2010:132:28-47.
45. Weiss HB. Entomological medicaments of the past. Journal of the New York Entomological Society,1947:55(2):155-168.