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Original Article

# Knowledge and Use of Traditional Medicinal Animals in the Arba Minch Zuriya District, Gamo Zone, Southern Ethiopia

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**ABSTRACT**

**Objective:** To collect ethnozoological data in connection with medicinal animals and their products used by the inhabitants of the Arba Minch Zuriya region of Ethiopia and to put on record information on traditional treatments of diseases and disorders.

**Methods:** The survey was conducted during the months of February to May 2018. Data were gathered through semi-structured surveys and depended on group discussions with 90 people, of which 17 were key and the remainder general informants.

**Results:** Altogether 20 animal species comprising 12 mammals, one bird, three reptiles, two insects, and two fish were used in 30 distinctive ways to treat disorders of the eye and skin ailments such as anaemia and malaria as well as various other disorders and injuries. Twenty percent of all health problems involved the skin. Bovidae were the most important medicinal animals with a use of 14%, and bile was the most widely employed animal product.

**Conclusion**: Traditional therapies involving animal species are still being practiced in rural areas of Ethiopia and this knowledge is of importance and should not get lost. However, Overexploitation and overhunting pose a serious threat to the therapeutic species. For the conservation and management of these species, the local residents' cooperation and understanding are needed.

**Keywords:** Therapeutic animals, ethnozoology, indigenous knowledge, traditional medicine

## INTRODUCTION

Throughout the world, humans and animals have interacted since time immemorial. Animals were feared, hunted, consumed, and used in various ways such as to treat diseases or as part of festivities and subjects in myths and beliefs.[1–4] Animals have played a larger than average scope of roles in virtual all human endeavours and their influence on religion, workmanship, music, dance, literature and other distinctive social articulations of humankind is undisputed. Specifically, focusing on the therapeutic uses of animals and their products in Ethiopia, information has been passed down orally from generation to generation. This knowledge needs to be seen as a major component of the Ethiopian human social legacy, but if unrecorded it is in danger of being lost.[5–7]

Recognizing the natural assets that wild and domestic therapeutic animal species represent, people living in Ethiopia and other developing countries have embarked on safeguarding the resource to render it sustainable.[5,8,9] According to data published by the WHO,[10] nearly 80% of the world's population live in developing countries where they largely depend on customary medication for treating sicknesses and ailments of humans and animals. There is not only an interest in the developing world, but also now a worldwide interest in documenting traditional healing methods from different parts of the globe involving animals and their products. Ethiopia is rich in ethnic communities whose languages, cultures, and traditions differ and whose members live in different parts of the country. What unites them all is that they have been using traditional methods of medication for generations, but that despite the long history of their ethnobotanical and ethnozoological knowledge, few attempts have been made in the past to record this knowledge.

To provide an inventory of the traditionally used medicinal animals for certain areas of Ethiopia, those of the Kafta-Humera District, Northern Ethiopia, were recorded by Giday et al.[5] Thirty traditional healers of that district reported that 16 species of animals (44% of which were domestic species) were used to treat 18 different human ailments. The parts and products of the animals that were used therapeutically included bile, milk, blood, pancreas, urine, hair, and fecal matter. Among the Amaro

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Woreda residents of Southern Ethiopia, investigated by Dereje and Meseret,[6] 90 respondents declared that 21 species of animals (14 mammals, four birds, and three reptiles) were used to prepare remedies for 46 ailments and that animal flesh (33.8%) had the highest use, followed by fat (11.5%), bone (8.6%), and blood (8.6%). Python, warthog, crested porcupine, and bushpig were of great relative importance (RI), but only 61.7% of the respondents did and 38.3% did not use traditional medicines, which in the majority of cases were administered orally.

Data based on information from 36 purposively selected respondents formed the basis of an ethnozoological study among the indigenous people of Metema Woreda in Northwest Ethiopia.[7] This study revealed that 51 species were used to treat around 36 different kinds of ailments. Although the majority of the animals used were mammals (27 species), the remainder contained birds (nine species), arthropods (seven species), reptiles (six species), and fish and annelids (one species each). The therapeutic use of rare or protected species, eg, cheetah, gazelle, elephant, monkeys, etc., was of some concern and highlighted the need to have more details on the traditional uses that indigenous people put native species to.

This present study was initiated to collect additional information on the uses of traditional medicinal practices from tribal areas within the Arba Minch Zuriya, Gamo Gofa Zone, Southern Ethiopia. Since until now no ethnotherapeutic uses had been reported from this rather remote region of Ethiopia, all our observations can be regarded as new. The main aim of this study was to enrich the country's database of medicinal animals and to provide additional information on the indigenous knowledge of ethnic communities in Ethiopia on how to use the species therapeutically without endangering their continued survival in the future.

## METHODS

### Description of the Study Area

Arba Minch is the capital of the Arba Minch Zuria district (Figure 1), around 437 km from Addis Abeba, the capital of Ethiopia. Arba Minch's longitude and latitude are 06°2'N and 37°33'E, respectively, and its altitude ranges from 1200 to 1285 masl. The temperature of the district ranges between 17 and 30°C. Precipitation is bimodal and amounts to 900 mm annually. The wet season covers the months March, April, and May, and September, October, and November but may extend up to December, January, and February.[11] According to the latest data available, ie, the 2007 census, the district had a population of 165,680 of which 82,774 were male and 82,906 were female.

### Main Points

- Traditional therapies involving animals and their products are still being used in rural parts of Ethiopia.
- Altogether 13 species of the therapeutic animals of the region (65%), involving mainly mammals and reptiles, were obtained from the wild, and seven (35%) represented domestic animal species. With a relative importance index of RI = 0.912, the fox Vulpes vulpes turned out to be the most versatile species.
- Thirty different kinds of preparation methods to treat disorders were recorded. The most important routes of administration were oral, dermal, and nasal.
- Overexploitation and overhunting pose a threat to the therapeutic species. For the conservation and management of these species, the local residents' cooperation and understanding are needed.

### Reconnaissance Survey and Study Site Selection

The surveillance was conducted from March 2017 to April 2018. Prior to the study, authorization to carry out the investigation was obtained from the local governing body. The approved methodology was followed, and the consent of the interviewed members was acquired. A decision on the choice of the study site depended on prior information that had been gathered from community pioneers, proficient seniors, and a number of customary healers of the area.

### Informant Selection

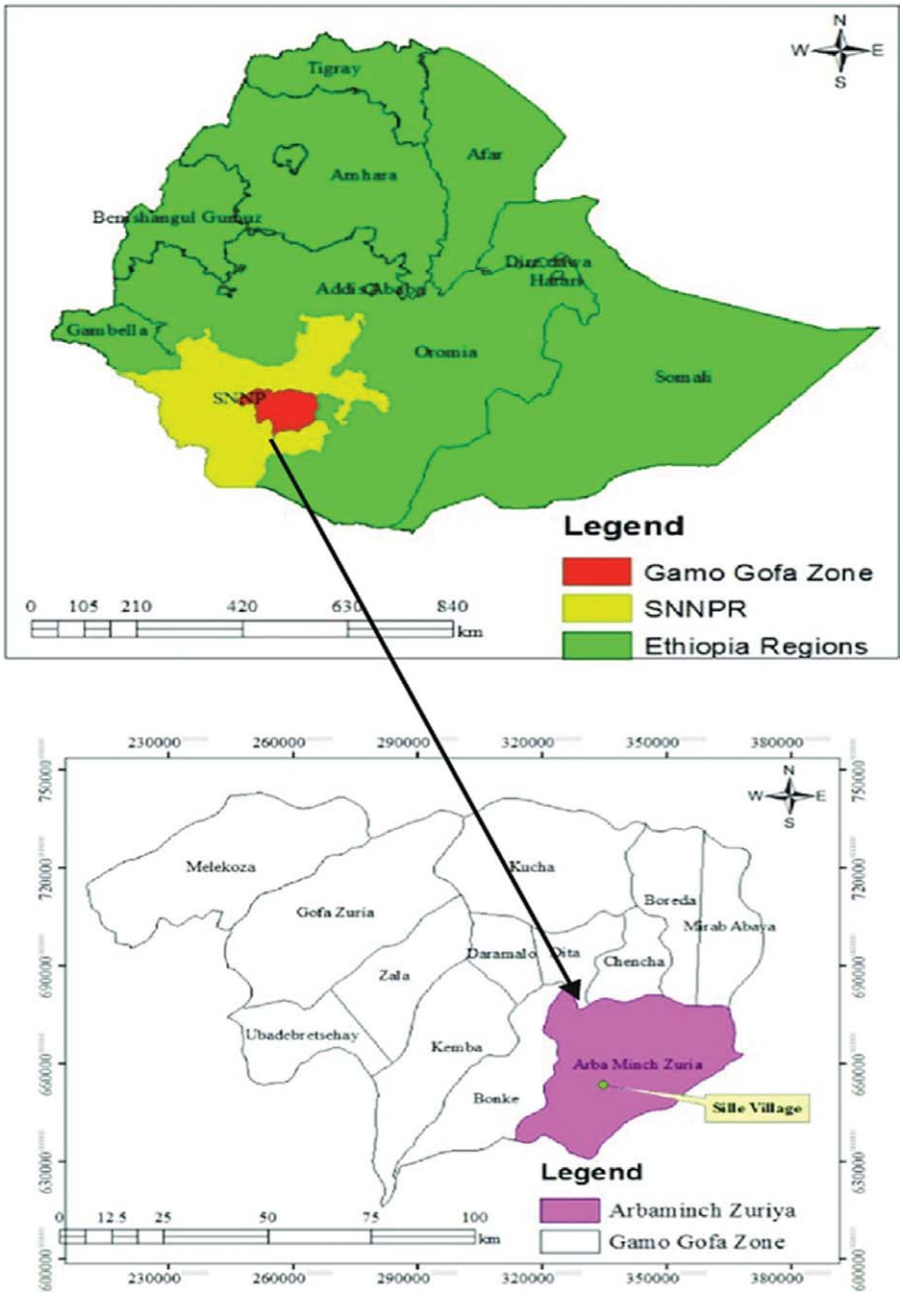
Ninety informants (45 males and 45 females) between 30 and 85 years of age were contacted during this research. Among these, 17 (nine males and eight females) were key informants, while the remainder of 73 were general informants. Random and purposive sampling strategies were employed to choose respective general informants and traditional healers. Affiliated pioneers and respected old individuals assisted with identifying the key informants. The general informants were randomly chosen during field and house visits. All interviews were administered after obtaining voluntary consent of every informant and assuring them that the data collected were used only for academic purposes.

### Data Collection and Identification

Following standard methods,[5–7,12] ethnozoological data assortment was accomplished from February to April 2018 by living in close contact with the community in the study region. Semistructured interviews, guided field walks, direct observations, and focus group discussions with key informants and other knowledgeable community members were carried out. The responses of our informants were copied down. The semistructured interviews contained a checklist of questions focusing on the vernacular names of medicinal animals, their habitats, parts of the animals or their products used, medication preparation methods, materials utilized during preparation, condition of preparation, additives/ingredients used during preparation and administration, dosage administrated, and route of administration. Moreover, reaction to the medication (assuming there was any) was likewise included.

Observations with informants on field walks took place to see and watch in their habitats those animals the informants referred to and produced voucher specimens of.[5] Besides focus group discussions with conventional healers, conversations with local knowledgeable people and key informants were held to obtain additional data and to check the reliability of their statements. On some occasions, the preparation methods of the therapeutic animals were meant to remain secret and were,

**Figure 1.** Map of Ethiopia and the study region




therefore, excluded from the discussion. Most field observations were directed with only one informant at a time in order to safeguard the secret information; this was what the healers specifically requested. Specimens were gathered on site, and together with the information of the local name and photographs, the dead skin, hair, fur, and other characteristic materials were taken to Arba Minch University (AMU) for inspection. Formal identification of the therapeutic animals was conducted by zoological experts of AMU, comparing the collected material with internet images and published animal keys. Molecular analyses of the collected therapeutic animals were not possible and not deemed necessary.

**Ethics Statement and Consent to Participate**

This investigation was approved by the Committee for Ethical Research of the Department of Biology, Arba Minch University (AMU/021/2017). Prior to collecting the data, in each case of an interview, we obtained oral informed consent to proceed. All informants were given detailed information on the objectives

**Table 1.** Household Characteristics of the Respondents (n = 90)

| | Sex | | Age group (in years) | | | | | Educational status | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | M | F | 20–30 | 31–40 | 41–50 | 51–60 | >60 | Illiterate | 1–4 grade | 5–8 grade | 9–10 grade | 11–12 grade |
| Frequency | 45 | 45 | 18 | 37 | 27 | 14 | 4 | 21 | 33 | 32 | 13 | 1 |
| Percentage | 50 | 50 | 18 | 37 | 27 | 14 | 4 | 21 | 33 | 32 | 13 | 1 |

**Table 2.** Proportion of Animal Species Used in Traditional Medical Treatments

| No. | Animal species | Number of species | Percentage |
|---|---|---|---|
| 1 | Mammals | 12 | 60 |
| 2 | Birds | 1 | 5 |
| 3 | Reptiles | 3 | 15 |
| 4 | Fish | 2 | 10 |
| 5 | Insects/arthropods | 2 | 10 |

of the research and understood that it was not carried out for business purposes but for scholastic reasons. All participants gave verbal informed consent to participate in this study; they were allowed to withdraw their information at any point of time. The informants completely accepted the idea and objectives of the study and consented to have their names and personal information published if required.

### Data Analysis

The ethnozoological data were analyzed using appropriate statistical tools such as Microsoft Office Excel Spreadsheet®. Excel was used to calculate sums and percentages and to tabulate and draw graphs. Descriptive statistics, for example, percentage and statistical distribution, were employed for analyzing animal habitat, animal part(s) or product(s) used, methods of preparation medication, dosages administrated, and route of administration. Data were presented in graphs and tables, and they were interpreted and discussed. The fidelity level quantifies the importance of a species for a given purpose. It refers to the share of informants claiming the employment of a specific animal species for the identical major purpose was calculated for the foremost frequently reported disease or ailments as FL (%) = (Np/N) × 100, where Np is the number of informants that claim a use of the animal species to treat a specific disease and N is the total number of informants that use the species as a medication to treat a given disease.[13]

The RI value is employed to quantify the variety of medicinal applications; it was computed for every claimed medicinal animal. The formula used was as follow: R = NP+NBS, where RI stands for relative importance and NP is the computed value obtained by dividing the quantity of properties (specific ailments treated) recognized in connection with a species divided by the overall number of properties attributed to the foremost versatile species (species with the best number of properties). The number of body systems (NBS) value is obtained by dividing the quantity of the body systems (ailment categories) treated by a given species by the overall number of body system treated by the foremost versatile species.[14]

## RESULTS AND DISCUSSION

### Socio-demographic Characteristics of the Respondents

Data on the socio-demographic attributes of the respondents with respect to age, sex, and educational status are introduced in Table 1. Of the 90 informants interviewed in the study region, 45 were male and 45 female. The majority of the informants (37%) were in the age group of 31-40, followed by 27% aged 41-50; just 18% of the respondents were in the 20-30-year-old group and 18% were over 50 years of age. Regarding their educational backgrounds, most of the respondents (33%) had completed the first cycle of primary education (1-4 grades), but only 13% had completed secondary high school (9-10 grades).

### Traditional Medicinal Animals Used by Peoples of the Study Area

Nineteen species of the therapeutic animals were gathered and archived from the study region (Table 2). Mammals registered the highest percentage in both number of animal parts and animal products (60%), trailed by reptiles (15%). In addition, 10% each of the therapeutically used species were identified as fishes and insects, and the sole representative of the birds, the domestic chicken, accounted for 5% of the medicinally utilized fauna-based groups of animals (Table 2). This outcome demonstrates that the interviewed people of the Arba Minch Zuria district have therapeutic uses for only a relatively small number but taxonomically wide range of diverse species of animals to treat diseases and bodily dysfunctions. The presence and usage of such few therapeutic animals by people in the study area suggests that the people of the region may increasingly use

nontraditional medication and drugs. However, conventional medicines are still considered useful and important, especially for the poor who have little access to modern medicines and do not have the money to pay for expensive new drugs. A similar number of diverse taxonomic groups of therapeutic animals and related ethnomedicinal knowledge has been reported from some other regions of Ethiopia.[5–7,12,14]

### Habitats and Abundance of Medicinal Animals

Altogether 13 species of the therapeutic animals of the region (65%) were obtained from the wild and seven (35%) represented domestic animal species. This shows that the traditional healers rely more on the wild than the domestic species and additionally hints at the possibility that some wild animal species of the study region could be overused. This observation in concert with the perception obtained in interviews affirmed that customary healers generally have less interest in employing domesticated species for their treatments of specific illnesses. Species used primarily as food (like the domestic animals) appear to be less appreciated as a source to treat sick people with. This finding agrees with observations on the therapeutic inventories of other tribes where wild medicinal animals also dominated[5–7,12] and could be driven to some extent by the consumers' preferences for drugs and potions from wild rather than domestic species.

### Animal Parts/Products Used as Traditional Medicine

Results of this segment of the survey showed that various parts of the medicinal species were utilized therapeutically by the local practitioners to prepare potions and remedies. Of the 20 kinds of therapeutic material to treat various health problems, meat (18%), bile (10%), and feces/excrement (10%), followed by blood (8%), teeth, bone, and milk (all 6%) of specific animals, were most commonly used (Table 3). The risk of destroying the medicinal animal resource is especially high in connection with meat and bile as these items are used for a wide range of illnesses and usually require the killing of an animal. Collecting therapeutic bile, meat, and teeth has consequences for the survival of an animal, but collecting feces, feathers, eggs, and honey usually has only a minor effect on the survival of an individual animal especially when contrasted with meat, bile, teeth, and bones (or bone fragments). Elsewhere in Ethiopia, meat, bile, teeth, and feces were often also the most commonly used animal parts used to treat medical issues,[5–7,12] although for the West Gojjam Zone of Javittenan, North Achefer, and Bahir Dar Zuria districts' honey and meat had the highest use followed by purified butter, milk, liver, and cheese.[15]

### Mode of Remedy Preparation

Local healers employ a great variety of methods to prepare traditional medicines. They frequently prepare some food to ingest (e.g. like a soup to which are added a variety of ingredients). However, direct uses dominate (68.97%), and soups with (6.90%) and without ingredients (6.90%) are the three main methods of producing a potent medicine (Table 4). Preparation and application methods vary, based on the types of disease to be treated, the actual site of the ailment, and the animal (or animal part) involved. A minority of preparations are made from mixtures of different animal species with water and a variety of different additives like honey, sugar, butter, salt, and milk. These added substances have different functions, e.g., to reduce the toxicity, to enhance the flavor, to lessen the chance of vomiting, and to avert diarrhea, and this could be the reason for the observation that one and the same animal part or product can be used to treat sometimes quite different organs or illnesses.[16] Specific herbal remedy preparations with their possible synergistic benefits may be prescribed.[17] Information was also provided that the medicine could be blended with regular food and beverages, so that it would either change in taste or could be taken without being noticed. Although in some cultures the placenta has a therapeutic role to play,[18] e.g., sheep placenta in traditional obstetrics in Nigeria,[19] no such uses were revealed by our informants, but it needs to be reiterated that the healers were very particular about certain treatments and animal uses that were considered too secret to be revealed.

### Routes of Administration

Various routes of administering the medicinal animal preparations are known to the people of the area. The most important routes of administration are oral, dermal, and nasal. Dermal application in the form of a lotion, cream, or plaster is the dominant route (50.00%), followed by oral application (46.43%) (Figure 2). Oral and dermal routes of administration permit quick interactions of the prepared medicines with pathogens or the inflamed tissue and enhance the medicines' curative power. They have been shown to be the most widely used forms of administration also in other parts of Ethiopia.[5–7,11] Nasal administration involves inhaling fumes and/or introduction of the therapeutic agent into the nose. It is the least common method of treatment.

### Relative Importance of Species and Fidelity Level

The RI of a species refers to the relative use of it in the preparation of the remedies. Material from the fox (*Vulpes vulpes*) is used to prepare remedies for four ailments, making the fox the most versatile species with an RI of 0.912. The two next most therapeutically important species are the cow (*Bos taurus*) and the chicken (*Gallus gallus*) with an RI of 0.881 each. These animals are followed by sheep (*Ovis aries*) (RI = 0.728), bats (RI = 0.681), goat (*Capra aegagrus*) (RI = 0.681), and *Papio anubis* monkeys (RI = 0.681) (Table 5). As an insect, the honey bee's score on the basis of its multipurpose product honey would be as high as 0.912, but considerably lower if we focused on the direct therapeutic use of its larvae alone.

The FL is determined to identify the most frequently treated malady or ailment category as mentioned by the informants. Skin-related diseases, i.e., various forms of dermatoses, vision-related problems, and malaria were the three main categories, scoring respective FL values of 0.5-4.00, 0.88-1.00, and 0.71-0.94. Species with an FL of 1.00 are the pig (*Sus scrofa)*, lacertilian lizards, the African warthog (*Phacochoerus africanus*), the goat (*Capra aegagrus hircus*), and snakes. The possibility exists to use different remedies for similar ailments[20] as has been shown for other regions elsewhere in the world, especially given irregular accessibility to particular species.[21] Alves and Alves[22] suggest that various species of therapeutic animals may have comparable restorative properties and that pharmacological scrutiny could possibly confirm their effectiveness as zoo-therapeutic cures.

**Table 3.** Therapeutic Species and Their Uses in Treating Specic Disorders in Human Subjects

| Name | Scientific name | Taxon | Habitat | Condition | Main part(s) used | Mode of preparation and method of administration | Organ or illness treated |
|---|---|---|---|---|---|---|---|
| Monkey | *Papio anubis* | Cercopithecidae | Domestic | Dry/dry | Fecal matter | Dried fecal matter is fumigated | Sleeping sickness |
| | | | | | Hind, skin | Hind or skin applied to heal | Broken/ displaced bone, burn wound |
| Cow | *Bos taurus* | Bovidae | Domestic | Fresh | Bile | Bile massaging around closed eye | Eye/vision |
| | | | | Fresh | Bile | Drinking the raw bile | Malaria |
| | | | | Fresh | Gut content | Massaging gut content around male genitals to stimulate the organ | Male sex organ |
| | | | | Fresh | Horns | Crushed horn taken with injera (traditional Ethiopian atbread) | Malaria |
| | | | | Fresh | Leg | Leg cuts with ingredients turned into a healthy soup | Wrist fracture |
| | | | | Fresh | Liver | Eaten directly | Anemia |
| | | | | Fresh | Spleen | Eaten directly | Anemia, malaria, trachoma |
| | | | | Fermented | Yoghurt | Eaten or drunk | Gastritis |
| Goat | *Capra hircus* | Caprinae | Domestic | Fresh | Oviduct | Mixed with butter and anointed to the head | Eye: vision disorder |
| | | | | Fresh/dry | Fecal matter | Dried, powdered, mixed with water, and smeared over the head | Fighting dandruff |
| | | | | Fresh | Milk | Directly given to drink | Eye problems, pain, headache, measles, TB, snake bite, vomiting, rheumatism |
| Sheep | *Ovis aries* | Caprinae | Domestic | Fresh | Bile | Drinking fresh bile | Malaria |
| | | | | | Blood | Drinking fresh blood | Anemia |
| | | | | | Milk | Drinking directly | Malaria |

**Table 3.** (Continued)

| Name | Scientific name | Taxon | Habitat | Condition | Main part(s) used | Mode of preparation and method of administration | Organ or illness treated |
|---|---|---|---|---|---|---|---|
| Pig | *Sus scrofa domesticus* | Suidae | Wild | Fresh | Meat | Consuming the meat | Rheumatism and headache |
| | | | | | Blood | Anointing the infected part | Skin infections |
| Warthog | *Phacochoerus* spp. | Suidae | Wild | Dry | Teeth | Heating the teeth and apply | Swellings, warts, toothache, and rheumatism |
| | | | | Fresh | Blood | Drinking directly | Malaria, asthma, and rheumatism |
| Hyena | *Crocuta crocuta* | Hyaenidae | Wild | Dry | Skin | Tying skin to the neck | Protection from "Evil eye" and "Bad Spirits" |
| | | | | Dry | Bone | Tying around the neck | Epilepsy and "Bad spirits" |
| Fox | *Vulpes vulpes* | Canidae | Wild | Fresh | Bile | Putting bile once/day on the nose for one week | Heart-related problems |
| | | | | Dry | Teeth | Tying teeth around the neck | Throat problems |
| | | | | Fresh | Pancreas | Tying pancreas to the arm | Spleen problems |
| | | | | Fresh | Blood | Smearing it on the scalp | For hair growth |
| | | | | Fresh/dry | Brain tissue and meat | Directly consumed | Epilepsy, mental disorders |
| Cat | *Felis catus* | Felidae | Domestic | Dry | Teeth | Rubbing teeth on the head | Skull glands |
| | | | | Dry | Skin | Tying it around part of body | Spiritual problems |
| Groundhog | *Marmota monax* | Sciuridae | Wild | Fresh | Meat | Pounded meat to be consumed | Fattening of body |
| Rabbit | *Oryctolagus cuniculus* | Leporidae | Wild | Dry | Meat | Rubbing dried meat over the injury | Skin problems |
| | | | | Dry | Fur | Fur is burnt; ash mixed with butter and creamed onto the burnt body part | Burns |
| Fruit bat | sp. | Pteropodidae | Wild | Dry | Bones | Inhaling fumes from fumigated bones | Mental illness |
| | | | | Dry | Meat | Consuming the dried meat | Mental disorder and hepatitis |

**Table 3.** (Continued)

| Name | Scientific name | Taxon | Habitat | Condition | Main part(s) used | Mode of preparation and method of administration | Organ or illness treated |
|---|---|---|---|---|---|---|---|
| Chicken | *Gallus gallus* | Phasianidae | Domestic | Fresh | Whole body | Cooked and eaten | Wound and injury |
| | | | | Dry | Excrement | Combining excrement with mud and applied to infected skin | Skin problems |
| | | | | Fresh | Eggs | Drinking raw egg yolk | Heart failure |
| | | | | Fresh | Liver and fat | Consumed raw | Pneumonia and swellings |
| Lizard | *Lacerta* spp. | Tropiduridae | Wild | Dry | Fecal matter | Pounded fecal matter, dried and with secret ingredients applied to swellings | Skin problems |
| | | | | Fresh | Whole body | Making a drink by adding water and salt | Cough and anemia |
| Python | *Python* sp. | Pythonidae | Wild | Dry | Bone | Crushing the bone, tying and banding | Rabies and swellings |
| | | | | Fresh/dry | Meat | Consumption and for anointing | Rabies, foot crack, and ear disorder |
| | | | | Fresh | Fat | Applied to infected area | Ear disease, wound |
| Snakes | *Bitis harenna* | Ophiidae | Wild | Dry | Brain, skin | Used fresh to rub over the eye | Eye: vision disorder |
| Nile perch | *Lates niloticus* | Percidae | Wild | Fresh | Bile | Drinking fresh bile directly | Eye disorder |
| | | | | Fresh/dry | Meat | Consumed directly | Rheumatism |
| Catfish | *Bagrus docmak* | Bagridae | Wild | Fresh/dry | Meat | Consumed directly | Rheumatism |
| Honey bee | *Apis mellifera* | Apidae | Domestic | Fresh | Honey | Eating or drinking the honey | Swarts, asthma, respiratory, throat pain, diarrhea, cough, TB, mumps, and heart failure |
| | | | | Fresh | Larvae | Consuming directly | Stomach disorder |
| Stingless bee | *Meliponula* spp. | Apidae | Wild | Fresh | Honey | Eating or drinking the honey | Stomachache, eye disorders, and coughs |

**Table 4.** Mode of Preparation of Traditional Medicines in the Study Area

| No. | Mode of preparation | No. of preparation | Percentage |
|---|---|---|---|
| 1 | Direct use | 20 | 68.97 |
| 2 | Soup | 2 | 6.90 |
| 3 | Ingredients added | 2 | 6.90 |
| 4 | Crushing | 1 | 3.45 |
| 5 | Heating | 1 | 3.45 |
| 6 | Binding | 1 | 3.45 |
| 7 | Drying | 1 | 3.45 |
| 8 | Pounding | 1 | 3.45 |

**Figure 2.** Major methods (routes) of traditional medicine administration in the study area

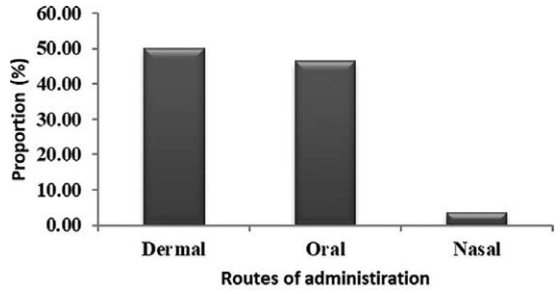



**Table 5.** Relative Importance (RI) of a Species

| Common name | Scientific name | Relative importance (RI) |
|---|---|---|
| Fox | *Vulpes vulpes* | 0.912 |
| Cow | *Bos taurus* | 0.881 |
| Chicken | *Gallus gallus* | 0.881 |
| Sheep | *Ovis aries* | 0.728 |
| Flying fox | *Cynopterus sphinx* | 0.681 |
| Goat | *Capra aegagrus hircus* | 0.681 |
| Monkey | *Papio anubis* | 0.681 |

**Risk of Zoonotic Disease**

Zoonosis alludes to illnesses, known zoonotic diseases, which are passed from animals to people. Animals can transmit harmful pathogens like viruses, bacteria, fungi, and parasites and consequently make people ill and ingestion of bile, for instance, as reported by Costa-Neto and Motta,[23] can transmit *Salmonella* spp., and lead to chronic diarrhea and even toxic shock. Zoonotic diseases may be mild or severe but may spread in the human population and lead to epidemics. Therefore, information on animal diseases (diseases transmitted between animals and humans) was sought.

We found that few respondents knew about the risk of zoonotic diseases and then only those that could read and write. This shows that the literate informants are likely to be less at risk of being contaminated with animal disease than those informants who are illiterate (uneducated). Although using therapeutic animals in treating diseases is generally considered a risk-free affair by consumers, zoonotic diseases are, nevertheless, increasing according to some of the illiterate (uneducated) respondents.[5,24] Thus, it seems necessary to warn of the dangers and the possibility to contract some of the more widespread zoonotic diseases like tuberculosis or rabies from animals, an aspect of considerable importance when dealing with animals and their tissues as remedies for human illnesses.

**Threats to Medicinal Animals**

In the Arba Minch Zuria district, the biggest threats for the future of the use of animals and their products in traditional remedies were according to our informants in the order of importance: (1) habitat loss and degradation, (2) overexploitation, (3) exotic species, (4) climate change, and (5) pollution. Ethnobotanical and ethnozoological research from elsewhere in Ethiopia had revealed very similar results.[5,25] Realistically, the incentive to conserve therapeutic animals within the area was seen to be very poor. However, a start is the awareness of the role of preservation in maintaining a sustainable use of the therapeutic animals in the Arba Minch and that needs to be supported in the region. It should be possible to find ways to halt the decline of the number of therapeutic animal species of the region by providing funds as well as land for domesticating therapeutic animals and helping the Traditional Healers Association in their activities with professional guidance.

## CONCLUSION

The results of the present study are new and have shown that people of the Arba Minch Zuria district traditionally use a variety of therapeutic animals. As elsewhere in Ethiopia, specific animal-based medicines are prepared by Arba Minch Zuria healers using wild and domestic species of not only primarily mammals but also reptiles and birds. Most practitioners obtain their animals and their products from the wild by hunting, which could affect the distribution and abundance of the untamed species. An accurate estimation of the effect is not possible until a systematic ecological inventory of the study area has become available. It was noted that the men of the region possessed a greater knowledge of the traditionally used medicinal animals than the females. The proximity to Nech Sar National park created access to interact with diverse wild animal species. Relatively small numbers of the urban and rural inhabitants within the study area rely only on traditional medicine, which suggests that the fashionable health service plays a significant role in filling the gap between traditional and modern medical care. However, as Meyer-Rochow[16] points out, what we must not do is to belittle or outright dismiss without any evidence a treatment method that for centuries has been an accepted way to confront a disease simply because it seems to be based on superstition or subscribes to the tenet of "let likes be cured by likes."

**Ethics Committee Approval**: Ethics committee approval was received for this study from the Ethics Committee of Arba Minch University (AMU/021/2017).

**Informed Consent**: An informed consent was obtained from all informants, and approval to carry out the study was given by the Ethics Committee of Arba Minch University.

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## REFERENCES

1. Alves RRN. Relationships between fauna and people and the role of ethnozoology in animal conservation. *Ethnobiol Conserv*. 2012;1(2):1-69.
2. Alves RRN, Souto WMS. Ethnozoology: A brief introduction. *Ethnobiol Conserv*. 2012;4:1-13.
3. Megu K, Chakravorty J, Meyer-Rochow VB. An ethnographic account of the role of edible insects in the Adi tribe of Arunachal Pradesh, North-East India. In Halloran A, Flore R, Vantomme P, Roos N (eds.): *Edible Insects of Sustainable Food Systems*. Cham, Switzerland: Springer Publ., 2018:35-54.
4. Jugli S, Chakravorty J, Meyer-Rochow VB. Tangsa and Wancho of North-East India use animals not only as food and medicine but also as additional cultural attributes. *Foods*. 2020;9(4):528. [CrossRef]
5. Gidey Y, Mekonen T, Yemane G. Ethnozoological study of traditional medicinal animals used by the people of Kafta-Humera District, Northern Ethiopia. *Int J Med Sci*. 2011;3(10):316-320. [CrossRef]
6. Dereje W, Meseret C. Ethnozoological study of traditional medicinal animals used by the Kore People in Amaro Woreda, Southern Ethiopia. *Int J Mol Evol Biodivers*. 2014;4(2):1-8.
7. Fasil AK, Sileshi AM, Melkamu AD. Ethnozoological study of traditional medicinal appreciation of animals and their products among the indigenous people of Metema Woreda, North-Western Ethiopia. *J Ethnobiol Ethnomed*. 2018;14:37.
8. Li S, Han Q, Qiao C, Song J, Cheng CL, Xu H. Chemical markers for the quality control of herbal medicines: An overview. *Chin Med*. 2008;3:7-8. [CrossRef]
9. Robinson MM, Zhang X. *The World Medicines Situation, Traditional Medicines: Global Situation Issues and Challenges*. Geneva: World Health Organization, 2011.
10. World Health Organization (WHO). *Traditional Medicine Strategy 2002–2005*. 1st ed. Geneva: WHO, 2002.
11. Mulugeta K, Gemechu L. Wild edible plant bio-diversity and utilization system in Nech Sar National Park, Ethiopia. *Int J Bioresour Stress Manag*. 2016;7(4):885-896. [CrossRef]
12. Tsegazeabe H. Traditional zootherapeutic studies in Degu'a Tembien, Northern Ethiopia. *Curr Res J Biol Sci*. 2012;4(5):563-569.
13. Friedman J, Yaniv Z, Dafni A, Palevitch D. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev desert. *Israel J Ethnopharmacol*. 1986;16:275-287. [CrossRef]
14. Bennett BC, Prance GT. Introduced plants in the indigenous pharmacopoeia of northern South America. *Econ Bot*. 2000;54:90-102. [CrossRef]
15. Motbaynor MM, Tadesse NS, Gashaw AM, Hailu AA. Documentation of traditional knowledge associated with medicinal animals in West Gojjam Zone of Amhara Region, Ethiopia. *Res Square*. 2020. DOI: 10.21203/rs.3.rs-31098/v1. Accessed August 26, 2020.
16. Meyer-Rochow VB. Therapeutic arthropods and other, largely terrestrial, folk-medicinally important invertebrates: A comparative survey and review. *J Ethnobiol Ethnomed*. 2017;13:9. [CrossRef]
17. Dawit A. Traditional medicine in Ethiopia. The attempt being made to promote it for effective and better utilization. *SINET: Ethiop J Sci*. 1986;9:61-69. [CrossRef]
18. Young SM, Benyshek DC. Review: In search of human placentophagy: A cross-cultural survey of human placenta consumption, disposal practices, and cultural beliefs. *Ecol Food Nutr*. 2010;49(6):467-484. [CrossRef]
19. Onuaguluchi G, Ghasi S. The pharmacological basis for the use of dried sheep placenta in traditional obstetric practice in Nigeria. *J Ethnopharmacol*. 1996;54:27-36. [CrossRef]
20. Ngokwey N. Home remedies and doctors remedies in Feira (Brazil). *Social Sci Med*. 1995;40(8):1141-1153. [CrossRef]
21. Alves RRN, Rosa IL. From cnidarians to mammals: The use of animals as remedies in fishing communities in NE Brazil. *J Ethnopharmacol*. 2006;107:259-276. [CrossRef]
22. Alves RRN, Alves HN. The faunal drugstore: Animal-based remedies used in traditional medicines in Latin America. *J Ethnobiol Ethnomed*. 2011;7(9):1-43. [CrossRef]
23. Costa-Neto EM, Motta PC. Animal species traded as ethnomedical resources in the Federal District, Central West region of Brazil. *Open Complement Med J*. 2010;2:24-30. [CrossRef]
24. Van Vliet N, Mertz O, Heinimann A, et al Trends, drivers and impacts of changes in swidden cultivation in tropical forest-agriculture frontiers: A global assessment. *Glob Environ Chang*. 2012;22(2):418-429. [CrossRef]
25. Getnet C, Zemede A, Ensermu K. Ethnobotanical study of medicinal plants in the environs of Tara-Gedam and Amba remnant forests of Libo Kemkem District, Northwest Ethiopia. *J Ethnobiol Ethnomed*. 2015;11(4):1-38.