Ethnozoological study of traditional medicinal appreciation of animals and their products among the indigenous people of Metema Woreda, North-Western Ethiopia

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Abstract

Background: Using animals for different purposes goes back to the dawn of mankind. Animals served as a source of food, medicine, and clothing for humans and provided other services. This study was designed to undertake a cross-sectional ethnozoological field survey among the residents of Metema Woreda from November 2015 to May 2016.

Methods: Data were collected through studied questionnaires, interviews, and focus group discussions with 36 purposively selected respondents.

Results: Ethnozoological data were collected of the local name of the animals, part of the animal used, mode of preparation and administration, and of additional information deemed useful. A total of 51 animal species were identified to treat around 36 different ailments. Of the animals used therapeutically, 27 species were mammals, 9 were birds, 7 arthropods, 6 reptiles, and 1 species each represented fish and annelids. Furthermore, the honey of the bee *Apis mellifera* was used to relieve many ailments and scored the highest fidelity value ($n = 35.97\%$). The snake (*Naja naja*) and the teeth of crocodiles (*Crocodylus spp.*) had the lowest fidelity value ($n = 2.56\%$).

Conclusion: The results show that there is a wealth of ethnozoological knowledge to be documented which could be of use in developing new drugs. Hence, it is hoped that the information contained in this paper will be useful in future ethnozoological, ethnopharmacological, and conservation-related research of the region.

Keywords: Traditional medicine, Indigenous knowledge, Ethnozoology, Zootherapy

Background

Using animals for different purposes goes back to the dawn of mankind. Animals served as a source of food, medicine, and clothing for humans and provided other services [1]. The traditional medicinal knowledge of indigenous people across the globe has played an important role in identifying living organisms which are endowed with medicinal values important for treating human and livestock health problems. Since ancient times, animals and their products have been used in the preparation of traditional remedies in various cultures [2]. Human societies have accumulated a vast store of knowledge about animals through the centuries, which is closely integrated with many other cultural aspects, and this zoological knowledge is an important part of our human cultural heritage [3].

The cure for human ailments using therapeutics from animals is known as zootherapy [4]. It plays a significant role in the healing practices, magic rituals, and religious societies all over the world [5, 6]. In the modern era, zootherapy constitutes a major alternative among many other known therapeutic practices in the world. Wild as well as domestic animals and their by-products such as hooves, skins, bones, feathers, and tusks serve as important ingredients in the preparation of curative, protective, and preventive medicines [5, 7, 8].

Traditional medicines have been important in connection with drugs like digitoxin, reserpine, tubocurarine, and
ephedrine [9]. Of the 252 essential chemicals that have been selected by the World Health Organization, 8.7% come from animals [10].

Loss of traditional knowledge of indigenous communities has impacted the development of modern medicine. It is important to document the traditional knowledge of human communities, since the majority of such communities are losing their socioeconomic and cultural characteristics [10]. Animals and the products derived from their body organs constitute part of the inventory of medicinal substances which are used widely by the people since time immemorial, and such practices still exist in traditional medicines [10]. Traditional healing methods involving hundreds of insect and other invertebrate species are reviewed by Meyer-Rochow [11]. In South Africa, animals and plants are commonly used as traditional medicines for both the healing of ailments and for symbolic purposes such as improving relationships and attaining good fortune [12].

In Traditional Chinese Medicine, more than 1500 animal species had been recorded to be some medicinal use [13]. In Brazil, Alves and Rosa reported the medicinal use of 283 animal species for the treatment of various ailments [14–17].

In Ethiopia, 70% of human and 90% of livestock population depend on traditional medicine. Although Ethiopians are known for their widespread use of traditional medicines with various levels of sophistication within the indigenous medical lore, the vast knowledge of the traditional uses of animal species of therapeutic value is not well documented for the various regions of the country. Moreover, since most of the knowledge is conveyed along generations through word of mouth, the traditional knowledge as well as the products used by these people is under threat [18].

In Metema Woreda, there were a number of studies about ethnobotany and traditional medicine, diversity, and floristic compositions of plants. However, despite the great diversity of ethnic groups and cultures in this area, ethnozoological studies of traditional medicinal animals have not yet been sufficiently addressed. Metema Woreda is characterized by the presence of a mosaic of ethnic groups with deep rooted culture of using traditional medicinal plants and animals. Hence, this study is aimed to explore ethnozoology and preparations of animals and its products as traditional medicine used to cure different human and animal ailments.

Methods
Study area description
The study was conducted in Metema Woreda in the Amhara National Regional State. The Woreda is about 333 km to the North West of Bahir Dar, the Capital City of Amhara Regional State. Metema is one of the Woredas in the Semien Gondar Zone, bordered by Qwara in the south, Sudan in the west, Mirab Armachiho in the north, Tach Armachiho in the northeast, Chilga in the east, and Takusa in the southeast. The Woreda constitutes a total of 20 Peasant Kebele administrations, of which 18 are rural-based peasant administration areas [19, 20]. The Woreda is the home of many ethnic groups including Agaw, Tigrie, Oromo, Gumuz, and Amhara migrated from the different angles of the country for different reasons displaying a diversity of cultures and indigenous belief.

Selection of study sites
A preliminary study was conducted in November 2015 to select specific study sites in the Woreda and test data collection tools. The study was conducted in six kebeles of Metema Woreda (Birshign; Kokit; Mender 6, 7, and 8; Metema Yohannis; Aftit; and Meka) from November 2015 to May 2016. These kebeles were purposively selected based on the availability of many traditional healers, presence of different ethnic groups, and accessibility of the area.

Sampling and data collection
The ethnozoological data (local name of animals, mode of preparation and administration, and part of the animal used) were collected through questionnaires, interviews, and focus group discussion with selected residents of Metema Woreda. Purposively, 36 key informants were selected, and questionnaires, interviews, and focus group discussion were made within these informants [21]. These informants were local herbalists, traditional healers, farming experts, midwives, and spiritual intellectuals. The selections of key informants were based on their experience and recognition as knowledgeable members concerning traditional zootherapeutics (the so called expert by the local people) [22]. Different types of ethnozoological data were collected from each type of key informants.

Group discussion
Brief group discussions were made at each site prior to the distribution of detailed questionnaires on the importance of animals in traditional medicine and related issues with the selected informants of the study site. During the discussions, an attempt was made to encourage the healers in such a way that their cooperation would be of benefit to the country and at same time an informed consent was obtained before data collection.

Semi-structured interviews
A semi-structured checklist and interview questions were prepared in advance. The interviews were based on this checklist, and some issues were raised promptly depending on the responses of an informant. The interview was held in Amharic, the language of the people by the researchers. The place and time for the discussion was set based on the interest of the informants.
Informant consensus
During the course of the study, each informant was visited three times in order to confirm the reliability of the ethnozoological information. Consequently, the responses of an informant that were not in harmony with each other were rejected since they were considered as unreliable information.

Animal specimen collections and identifications
The local names and associated attributes of medicinal animals were recorded for each of the species. The specimens with its common name, photograph, dead skin, hair, fur, and some products were collected and taken to Bahir Dar University (BDU) for species identification. Identification of the medicinal animals was done in BDU, using Internet and animal key by comparison with collected plates and illustrations.

| Basic information | Number of respondents | Percentage (%) |
|-------------------|-----------------------|----------------|
| Sex               |                       |                |
| Male              | 34                    | 94.4           |
| Female            | 2                     | 5.6            |
| Age               |                       |                |
| 35–44 years       | 6                     | 16.7           |
| 45–60 years       | 20                    | 55.5           |
| > 60 years        | 10                    | 27.8           |
| Educational level |                       |                |
| Illiterate        | 15                    | 41.7           |
| Literate          | 21                    | 58.3           |
| Marital status    |                       |                |
| Married           | 34                    | 94.4           |
| Single            | 1                     | 2.8            |
| Divorced          | 1                     | 2.8            |

| No. Questions | Choices                        | No. of respondents | Percentage (%) |
|---------------|--------------------------------|--------------------|----------------|
| 1             | Where did you learn traditional medicinal knowledge? | A) Family 16 | 44.4 |
|               |                                 | B) Books 4 | 11.1 |
|               |                                 | C) Surrounding society 12 | 33.3 |
|               |                                 | D) Experience 4 | 11.1 |
|               |                                 | Total 36 |                |
| 2             | How many times people use traditional medicines? | A) Sometimes 15 | 41.7 |
|               |                                 | B) Always 13 | 36.1 |
|               |                                 | C) Situational 8 | 22.2 |
|               |                                 | Total 36 |                |
| 3             | What was the reason that forces the people to use traditional medicines? | A) Economy 7 | 19.4 |
|               |                                 | B) Lack of modern medicine 10 | 27.8 |
|               |                                 | C) Effectiveness 19 | 52.8 |
|               |                                 | Total 36 |                |
| 4             | Which categories of people use traditional medicines in large quantity? | A) Ethnic group 5 | 13.9 |
|               |                                 | B) Nations 1 | 2.8 |
|               |                                 | C) Religion 5 | 13.9 |
|               |                                 | D) All 25 | 69.4 |
|               |                                 | Total 36 |                |
| 5             | What looks like the outlooks of people about use of traditional medicines? | A) Good 15 | 41.7 |
|               |                                 | B) Bad 1 | 2.8 |
|               |                                 | C) Intermediate 20 | 55.5 |
|               |                                 | Total 36 |                |
| 6             | Are there any conservation and documentation mechanisms of traditional medicinal animals? | A) Yes 3 | 8.3 |
|               |                                 | B) No 31 | 86.1 |
|               |                                 | C) Some 2 | 5.5 |
|               |                                 | Total 36 |                |
Data analysis
The data obtained were summarized and analyzed using descriptive statistical methods. In the ethnozoological data that were obtained from the interviews on reported medicinal animals and associated knowledge, fidelity level (FL) was calculated as the percentage of respondents claiming the use of a certain animal species for the same ailments, for the most frequently reported diseases or ailments as

\[ FL(\%) = \frac{N_p}{N} \times 100 \]

where \( N_p \) is the number of respondents that claim a use of a species to treat a particular disease and \( N \) is the number of respondents that use the animals as a medicine to treat any given disease [23]. The range of fidelity level (FL) is from 1 to 100%; high values indicate that this particular animal species is used by large number of people, while a low value shows that respondents disagree on the usefulness of a species in treating ailments.

Results
This study revealed the traditional medicinal knowledge of treating various kinds of ailments using different animals and their parts/products by local inhabitants of different kebeles of Metema Woreda (North-Western Ethiopia). Many people were found to lack formal schooling education, but they have knowledge about the use of local animal resources for traditional medicines.

Socio-demographic characteristics of the respondents such as sex, age, educational level, and marital status were collected and presented (Table 1).

Information regarding the way to acquire traditional medicinal knowledge, duration of time to use traditional medicine, the reason that forces the people to use traditional medicines, categories of people that use traditional medicine, the outlooks of people about the use of traditional medicine, conservation, and documentation mechanisms of traditional medicinal animals were gathered from all respondents (Table 2).

Fifty-one animal species (Table 5) were found to be used for the treatment of over 36 kinds of ailments. There were 27 species belonging to mammals, 9 to birds, 7 arthropods, 6 reptiles, and 1 each among the fish and annelid (Table 3). The animals and their parts/products were found to be used for the treatment of around 36 different kinds of ailments including rheumatism, malaria, wart, stomachache, toothache, herpes, headache, rabies, tuberculosis, anemia, trachoma, gastritis, asthma, paralysis, and cough. The animals were used as whole or their products like milk, blood, organ, meat, teeth, and honey for the treatment of various ailments (Table 8).

According to the data (Table 4), meat/fat was the most widely used medicinal parts/products of animals in traditional medicine, followed by visceral organs, products and bone/teeth, and external body parts with similar percentages. On the other hand, an animal’s whole body and excreta, and blood were found to be the least used medicinal parts/products of animals.

In the study area, different parts or products of animals were used to treat different types of ailments. The highest number of cow parts or products 8 (3.8%) used to treat 8 (4.5%) ailments. The second rank was occupied by common warthog (*Phacochoerus africanus*), porcupine (*Hystrix* spp.), spotted hyena (*Crocuta crocuta*), and elephant (*Elephas maximus*) with similar number of parts/products 5 (2.5%) and used to treat 8 (4.5%), 13 (7.

### Table 3
Animal groups and number of species used for traditional medicine in the study area

| No. | Animal groups | Number of species | Percentage (%) |
|-----|---------------|------------------|----------------|
| 1   | Mammals       | 27               | 52.9           |
| 2   | Birds         | 9                | 17.6           |
| 3   | Reptiles      | 6                | 11.8           |
| 4   | Fish          | 1                | 2              |
| 5   | Arthropods    | 7                | 13.7           |
| 6   | Annelid       | 1                | 2              |

### Table 4
Animal parts or products used to traditional medicine in the study area

| No. | Medicinal parts/products of animals | No. of parts/products used | Percentage (%) |
|-----|------------------------------------|----------------------------|----------------|
| 1   | Meat/fat                           | 23                         | 23.5           |
| 2   | Visceral organ (liver, spleen, Bile, stomach/intestine) | 21                         | 21.4           |
| 3   | Products (honey, venom, milk, butter) | 13                         | 13.3           |
| 4   | Bone/teeth                         | 12                         | 12.2           |
| 5   | External Body part (head, tail, leg, skin, horn, spine/thorn) | 12                         | 12.2           |
| 6   | Excreta (stool and urine)           | 6                          | 6.1            |
| 7   | Whole body                         | 6                          | 6.1            |
| 8   | Blood                              | 5                          | 5.1            |
Table 6 Medicinal animals and their parts/products used and number of ailments treated

| Animal group | Common name | Local name | Scientific name | No. of parts/products used \(N\) (\%\) | No. of ailments treated \(N\) (\%) |
|--------------|-------------|------------|-----------------|--------------------------------|---------------------------------|
| Mammals      | Wild boar   | Ria        | Sus scrofa      | 1 (0.5)                        | 4 (2.2)                         |
|              | Common warthog | Kerker | Phacochoerus africanus | 5 (2.5) | 8 (4.5) |
|              | Cow         | Lam       | Bos taurus      | 8 (3.9)                        | 8 (4.5)                         |
|              | Cheetah     | Aboshemane | Acinonyx jubatus | 1 (0.5) | 1 (0.6) |
|              | Camel       | Gimel     | Camelus dromedaries | 1 (0.50) | 4 (2.2) |
|              | Porcupine   | Jart      | Hystrix spp.    | 5 (2.5)                        | 13 (7.3)                        |
|              | Human       | Sew       | Homo sapiens    | 1 (0.5)                        | 1 (0.6)                         |
|              | Donkey      | Ahiya     | Equus africanus asinus L. | 1 (0.5) | 5 (2.8) |
|              | Rat         | Ayti      | Rattus spp.     | 3 (1.5)                        | 3 (1.7)                         |
|              | Spotted hyena | Gib | Crocuta crocuta | 5 (2.5) | 11 (6.2) |
|              | Gazelle     | Agazen    | Gazella spp.    | 2 (1.0)                        | 2 (1.1)                         |
|              | Goat        | Fiyel     | Capra aegagrus hircus L. | 4 (2.0) | 12 (6.7) |
|              | Hippopotamus | Gumare | Hippopotamus amphibius | 1 (0.5) | 3 (1.7) |
|              | Pigs        | Asama     | Sus scrofa domesticus | 2 (1.0) | 3 (1.7) |
|              | Monitor lizard | Arjano | Varanus spp.    | 1 (0.5)                        | 1 (0.6)                         |
|              | Sheep       | Beg       | Ovis aries      | 1 (0.5)                        | 1 (0.6)                         |
|              | Olive baboon | Zingero | Papio anubis    | 3 (1.5)                        | 4 (2.2)                         |
|              | Cat         | Dimet     | Felis domesticus | 1 (0.5)                        | 1 (0.6)                         |
|              | Elephant    | Zihon     | Elephas maximus | 5 (2.5)                        | 7 (3.9)                         |
|              | Bear        | Dib       | Melursus ursinus | 1 (0.5)                        | 1 (0.6)                         |
|              | Vervet monkey | Tota | Chlorocebus pygerythrus | 1 (0.5) | 2 (1.1) |
|              | Common fox  | Kebero    | Canis spp.      | 2 (1.0)                        | 5 (2.8)                         |
|              | Giraffe     | Kechine   | Giraffa camelopardalis | 2 (1.0) | 1 (0.6) |
|              | Dog         | Wusha     | Canis familiaris | 1 (0.5)                        | 1 (0.6)                         |
|              | Ethiopian hare | Tinchel | Lepus fagani    | 3 (1.5)                        | 4 (2.2)                         |
|              | Groundhog   | Shikaka   | Marmota monax   | 1 (0.5)                        | 1 (0.6)                         |
|              | Bat         | Yeelilet wof | Cynopterus sphinx | 1 (0.5)                        | 2 (1.1)                         |
| Birds        | Vulture     | Timb ansa | Gypss spp.      | 2 (1.0)                        | 2 (1.1)                         |
|              | Pigeon      | Ergib     | Columba livia   | 1 (0.5)                        | 3 (1.7)                         |
|              | Duck        | Dackye    | Duck spp.       | 1 (0.5)                        | 1 (0.6)                         |
|              | Ostrich     | Segon     | Struthio camelus | 3 (1.5)                        | 3 (1.7)                         |
|              | Hen         | Dero      | Gallus gallus domesticus | 3 (1.5) | 4 (2.2) |
Table 6 Medicinal animals and their parts/products used and number of ailments treated (Continued)

| Animal group | Common name | Local name | Scientific name            | No. of parts/products used | No. of ailments treated |
|--------------|-------------|------------|-----------------------------|----------------------------|-------------------------|
|              |             |            |                             | **N (%)**                  | **N (%)**               |
| Osprey       | Gedie       | Pandion haliaetus | 1 (0.5)                  | 2 (1.1)                    |
| Erckel’s francolin | Koki     | Pternistis erckelli | 2 (1.0)                | 2 (1.1)                    |
| Red billed oxpecker | Arechi  | Buphagus erythrorhynchus | 1 (0.5)               | 1 (0.6)                    |
| Bald eagle   | Chilat      | Haliaeetus leucocephalus | 1 (0.5)               | 1 (0.6)                    |
| Reptiles     | Snake       | Ebab       | Naja naja                   | 3 (1.5)                  | 6 (3.4)                 |
|              | Crocodile   | Azo        | Crocodylus spp.            | 3 (1.5)                  | 5 (2.8)                 |
|              | Python      | Zendo      | Python spp.                | 4 (2.0)                  | 7 (3.9)                 |
|              | Tortoise    | Ali        | Testudo graeca             | 1 (0.5)                  | 2 (1.1)                 |
|              | Chameleon   | Esist      | Chamaeleo chamaeleon       | 1 (0.5)                  | 1 (0.6)                 |
|              | Lizard      | Enshilait  | Lacertilia spp.            | 1 (0.5)                  | 2 (1.1)                 |
| Fish         | Fish        | Assa       | Any fish spp.              | 2 (1.0)                  | 2 (1.1)                 |
| Arthropods   | Scorpion    | Ginti      | Palamnaeus swammerdami     | 1 (0.5)                  | 1 (0.6)                 |
|              | Bees        | Nib        | Apis mellifera             | 2 (1.0)                  | 13 (7.3)                |
|              | Termite (Queen) | Mist  | All spp.                   | 1 (0.5)                  | 1 (0.6)                 |
|              | Field cricket | Fenta    | Gryllus campestris         | 1 (0.5)                  | 1 (0.6)                 |
|              | Gnat (small insect) | Tinign | All spp.                   | 1 (0.5)                  | 3 (1.7)                 |
|              | Bomble bee  | Tinizia    | Bombus spp.                | 1 (0.5)                  | 3 (1.7)                 |
|              | Ticks       | Meziger    | All tick spp.              | 1 (0.5)                  | 1 (0.6)                 |
| Annelid      | Leeches     | Alekit     | All spp.                   | 1 (0.5)                  | 1 (0.6)                 |
Preparations varied according to ailment and involved cooking, burning, crushing/grinding, wrapping, powdering, and drying or the use of fresh animal parts/products (Table 6).

The traditional medicines were administrated via different modes. Eating, followed by drinking, tying, anointing, banding and massaging and, fumigation and heating were the major modes of application (Table 7). Solids and liquids were administered orally, whereas banding, heating, anointing, and massaging materials were applied to the skin. Medicinal fumes were allowed to enter the body via the nose, while some parts of animals like bones, skin, and teeth were believed to serve a healing purpose by tying them on the neck or other parts of the body. Most of the remedies did not involve the addition of substances like sugar, water, butter, honey, teff and millet flour, salt, spice, milk, egg, and coffee, but there were cases in which such additives were used.

Fidelity levels (FL) demonstrate the percentage of respondents claiming the use of a certain animal or its product for the same ailments. The honey of bee species (Apis mellifera) used to relieve wart, asthma, diarrhea, throat pain, stomach ache, cough, and tuberculosis had the highest FL (n = 35, 97%) followed by meat of wild boar (Sus scrofa) to treat rheumatism, syphilis, stomach ache, and malaria (n = 32, 89%), milk of goat (Capra aegagrus hircus) to treat eye disease, gastritis, headache, measles, tuberculosis, vomiting, and rheumatism (n = 27, 75%), teeth of the common wart hog (Phacochoerus africanus) to treat tooth ache, wart, and rheumatism (n = 26, 72%), meat of the porcupine (Hystrix spp.) to treat swelling, tuberculosis, headache, AIDS, asthma, rheumatism, and gastritis (n = 24, 67%), and urine of Gazelle (Gazella spp.) to treat urination problems (n = 23, 64%). On the other hand, bile of common fox (Canis spp.) to cure eye problem and tooth ache (n = 2, 5.6%), the upper skin of the snake (Naja naja) to cure headache (n = 2, 5.6%), and the teeth of crocodile (Crocodylus spp.) to cure epilepsy (n = 2, 5.6%) have the lowest fidelity level value (Table 8).

### Discussion

In Ethiopia, 70% of human and 90% of livestock population depend on traditional medicine [18]. In this study, 51 animal species and their products were collected and identified that were believed to be a cure/prevention of over 36 kinds of ailments. Other studies reported in Ethiopia showed that approximately 23 animals and/or their parts were identified to be used in traditional medicines in Degu tribes in Tigray region [22]. Sixteen species of medicinal animals were collected and identified for treating 18 different human ailments in the Kaffa-Humera District, Northern Ethiopia [24]. The study conducted by Borah and Prasad recorded a total of 44 different species of animals which are used for the treatments of 40 different ailments [21]. In South Africa, Whiting et al. identified 147 medicinal vertebrate species representing 60 mammal species, 33 reptile species, 53 bird species and 1 amphibian species [12]. Oliveira et al. also described 23 animal species that used as traditional medicines [25]. Of a total 36 vertebrate species used in the treatment of ailments and disease, mammals comprised 50%; they were birds, fishes, reptile, and amphibians [26].

The inhabitants of the study area were found to use different parts/products of animals for the treatment of different kinds of ailments. Animals and the products derived from their body organs constitute part of the inventory of medicinal substances [10]. Meyer-Rochow also reported different organs of invertebrate animals used as traditional medicines [11].

In this study, parts/products of medicinal animals were grouped under meat/fat, blood, visceral organ, whole body, excreta, bone/teeth, and product categories and these categories were similar to ones reported by Haileselasie [22]. Other researches also stated that wild and domestic animals and their by-products such as hooves, skins, bones, feathers, and tusks are important ingredients in the preparation of curative, protective, and preventive medicine [7-9].

Preparations varied according to ailment and involved cooking, burning, crushing/grinding, wrapping, powdering, and drying [11]. In this study, egg is considered as one of the products of animals. The egg of ostrich (Struthio camelus) was mentioned as a traditional medicine in Table 8. It is used to treat muscle strain, broken bone, and paralysis. Gidey Yirga et al. showed medicinal animals have various methods of preparation for different types of ailments like crushing, powdering, squeezing, direct use, and cooking [27]. Haileselasie reported that animals are used as whole or body parts or by-products like milk, blood, organ, flesh, antler, and feathers for the treatments of different kinds of human ailments including cough, asthma, tuberculosis, paralysis, earache, herpes, weakness, and muscular pain [22].

### Table 7 Methods of preparation of traditional medicinal in the study area

| No. | Types of preparation | No. of preparation | Percentage (%) |
|-----|----------------------|--------------------|----------------|
| 1   | Fresh                | 40                 | 36.4           |
| 2   | Cooking              | 26                 | 23.6           |
| 3   | Burning              | 15                 | 13.6           |
| 4   | Crushing/grinding    | 8                  | 7.3            |
| 5   | Wrapping             | 8                  | 7.3            |
| 6   | Powdering            | 7                  | 6.4            |
| 7   | Drying               | 6                  | 5.4            |
| Animal group | Common name  | Scientific name | Parts/product used | Ailments treated                                                                 | No. of respondents claimed (n) | Fidelity level (FL) | Mode of applications |
|--------------|--------------|-----------------|--------------------|----------------------------------------------------------------------------------|-------------------------------|--------------------|----------------------|
| Mammals      | Wild boar    | Sus scrofa      | Meat               | Rheumatism, syphilis, stomachache, and malaria                                   | 32                            | 89                 | Eating               |
|              |              |                 |                    |                                                                                  |                               |                    |                      |
|              | Common warthog | Phacochoerus africanus | Teeth             | Swelling, toothache, wart and rheumatism                                          | 26                            | 72                 | Heating              |
|              |              |                 | Blood              | Malaria, asthma, and rheumatism                                                    | 12                            | 33                 | Drinking             |
|              |              |                 | Skin               | Herpes                                                                            | 4                             | 11                 | Anointing            |
|              |              |                 | Bile               | AIDS                                                                              | 8                             | 22                 | Drinking             |
|              |              |                 | Horn               | Swelling                                                                          | 4                             | 11                 | Heating              |
|              | Cow          | Bos taurus      | Butter             | Malaria and paralysis                                                              | 8                             | 22                 | Eating               |
|              |              |                 | Milk               | Rabies and TB                                                                     | 18                            | 50                 | Drinking             |
|              |              |                 | Urine              | Malaria                                                                           | 4                             | 11                 | Drinking             |
|              |              |                 | Spleen             | Anemia, malaria and trachoma                                                       | 13                            | 36                 | Eating               |
|              |              |                 | Omasum             | Gastritis                                                                         | 4                             | 11                 | Eating               |
|              |              |                 | Liver              | Anemia                                                                            | 9                             | 25                 | Eating               |
|              |              |                 | Blood              | Wart                                                                              | 10                            | 28                 | Drinking             |
|              | Cheetah      | Acinonyx jubatus | Skin               | Hemorrhage                                                                        | 3                             | 8                  | Tying                |
|              | Camel        | Camelus dromedarius | Milk             | Headache, rheumatism, malaria and diarrhea                                         | 20                            | 56                 | Drinking             |
|              | Porcupine    | Hystrix spp.    | Meat               | Swelling, TV, headache, AIDS, asthma, rheumatism, gastritis, and hypertension     | 24                            | 67                 | Eating               |
|              |              |                 | Bile               | Asthma/diabetes, stomach scramble                                                  | 11                            | 31                 | Drinking             |
|              |              |                 | Stomach/intestine  | Diarrhea and diabetes                                                             | 7                             | 19                 | Eating               |
|              |              |                 | Thorn/spine        | Wound and broken leg                                                               | 14                            | 39                 | Tying                |
|              |              |                 | Liver              | Diabetes disease                                                                  | 3                             | 8                  | Eating               |
|              | Human        | Homo sapiens    | Stool              | Wart                                                                              | 3                             | 8                  | Anointing            |
|              | Donkey       | Equus africanus asinus L. | Milk             | Measles, cough, trachoma/rabies, and internal problem                              | 22                            | 61                 | Drinking             |
|              | Rat          | Rattus spp.     | Meat               | Intestinal disease                                                                | 5                             | 14                 | Eating               |
|              |              |                 | Foot               | Nightmare                                                                         | 4                             | 11                 | Tying                |
|              |              |                 | Blood              | Wart                                                                              | 6                             | 17                 | Anointing            |
|              | Spotted hyna | Crocuta crocuta | Bone               | Epilepsy and bad spirit                                                            | 12                            | 33                 | Tying                |
|              |              |                 | Skin               | Protection from evil eye and during labor                                          | 9                             | 25                 | Tying                |
|              |              |                 | Bile               | Erythroblastosis and nightmare                                                     | 8                             | 22                 | Tying                |
|              |              |                 | Liver              | Infection of skin                                                                 | 5                             | 14                 | Banding              |
|              |              |                 | Skin               | For communicable diseases and bad spirit                                           | 11                            | 31                 | Tying                |
|              |              |                 | Meat               | For swollen sex organ, epilepsy and anemia                                        | 5                             | 14                 | Eating               |
|              | Gazelle      | Gazella spp.    | Urine              | For urination problem                                                             | 23                            | 64                 | Drinking             |
| Animal group | Common name | Scientific name | Parts/product used | Ailments treated | No. of respondents claimed (n) | Fidelity level (FL) | Mode of applications |
|-------------|-------------|-----------------|--------------------|------------------|-------------------------------|-------------------|---------------------|
| Goat | Capra aegagrus hircus L. | Bile | Syphilis | 0 | Drinking | |
| Goat | Capra aegagrus hircus L. | Milk | Eye disease, gastritis, wound, headache, measles, TB, eye disorder, vomiting, snake poison, and rheumatism | 27 | 75 | Drinking |
| Goat | Capra aegagrus hircus L. | Fat | Wound and Toothache | 16 | 44 | Banding |
| Goat | Capra aegagrus hircus L. | Liver | Trachoma | 7 | 19 | Massaging |
| Goat | Capra aegagrus hircus L. | Butter | Headache and ear infection | 8 | 22 | Massaging |
| Hippopotamus | Hippopotamus amphibius | Bone | Breast swelling, sunburn, and body fracture | 6 | 17 | Banding, drinking |
| Pig | Sus scrofa | Meat | Rheumatism and headache | 4 | 11 | Eating |
| Pig | Sus scrofa | Blood | Skin infection | 4 | 11 | Anointing |
| Monitor lizard | Varanus spp. | Skin | Infant communicable disease | 6 | 17 | Tying |
| Sheep | Ovis aries | Milk | Malaria | 4 | 11 | Drinking |
| Olive baboon | Papio anubis | Hind skin/skin | Broken/misplaced bone and wound/burning | 9 | 25 | Tying |
| Olive baboon | Papio anubis | Meat | Rabies prevention for dogs and HIV/AIDS | 13 | 36 | Eating |
| Cat | Felis domesticus | Bile, meat | AIDS | 6 | 17 | Eating, drinking |
| Cat | Felis domesticus | Skin | Spiritual problem | 3 | 8 | Tying |
| Elephant | Elephas maximus | Bile | Kidney failure | 3 | 8 | Drinking |
| Elephant | Elephas maximus | Bone | Herpes and diarrhea | 6 | 17 | Massaging |
| Elephant | Elephas maximus | Ivory | Herpes | 3 | 8 | Anointing |
| Elephant | Elephas maximus | Urine | Herpes, urination disorder | 3 | 8 | Drinking |
| Elephant | Elephas maximus | Skin | Herpes, back pain, skin wound, and trachoma | 6 | 17 | Anointing |
| Bear | Melursus ursinus | Bile | Epilepsy | 4 | 11 | Drinking |
| Vervet monkey | Chlorocebus pygerythrus | Meat | For STDs, anemia for children | 3 | 8 | Eating |
| Common fox | Canis spp. | Brain tissue and meat | Epilepsy, mental disorder | 4 | 11 | Eating/drinking |
| Common fox | Canis spp. | Bile | Toothache, eye problem, and internal problem | 2 | 5.6 | Drinking |
| Giraffe | Giraffa camelopardalis | Urine and milk | TB | 3 | 8 | Drinking |
| Dog | Canis familiaris | Bone | Epilepsy | 3 | 8 | Tying |
| Ethiopian hare | Lepus fagani | Excreta | Soars/wound | 4 | 11 | Anointing |
| Ethiopian hare | Lepus fagani | Meat | Cattle disorder, epilepsy | 8 | 22 | Fumigation, drinking |
| Ethiopian hare | Lepus fagani | Fat | Wart | 5 | 14 | Anointing |
| Groundhog | Marmota monax | Meat | For coughing and fattening baby | 7 | 19 | Eating |
| Bat | Cynopterus sphinx | Meat | Hepatitis, mental disorder | 21 | 58 | Eating |
| Vulture | Gyps spp. | Leg | Epilepsy | 3 | 8 | Fumigation |
| Vulture | Gyps spp. | Meat | Mental disorder | 4 | 11 | Eating |
| Pigeon | Columba livia | Meat | Mental disorder, body fracture, and heart failure | 12 | 33 | Eating |
| Animal group | Common name | Scientific name | Parts/product used | Ailments treated | No. of respondents claimed (n) | Fidelity level (FL) | Mode of applications |
|--------------|-------------|-----------------|-------------------|-----------------|--------------------------------|--------------------|---------------------|
| Duck         | Duck spp.   | Meat            | TB                | 4               | 11                             | Eating             |
| Ostrich      | Struthio camelus | Meat and egg | Muscle strain and broken bone and paralysis | 4 | 11 | Massaging, anointing |
| Hen          | Gallus gallus domesticus | Whole body | For physical injury and wound | 9 | 25 | Drinking |
|             |             | Liver and fat | Swelling wound, pneumonia | 16 | 44 | Eating |
| Osprey       | Pandion haliaetus | Bone | Epilepsy, body fracture | 5 | 14 | Tying |
| Erckel’s francolin | Pternistis erckelli | Meat | Internal problem | 3 | 8 | Eating |
| Red billed Oxpecker | Buphagus erythrorhynchus | Bile | STDS | 3 | 8 | Drinking |
| Bald eagle   | Haliaeetus leucocephalus | Blood | Skin fungus | 4 | 11 | Anointing |
| Reptiles     | Snake       | Naja naja       | Coat | 2 | 5.6 | Tying |
|              |             | Venom           | Malaria and snake bite | 4 | 11 | Anointing |
|              |             | Head            | Diarrhea, evil eye, and headache | 6 | 17 | Tying |
| Crocodile    | Crocodylus spp. | Bile | Coughing, TB, teeth rheumatism | 4 | 11 | Drinking, Anointing |
|              |             | Bone            | Communicable disease | 3 | 8 | Tying |
|              |             | Teeth           | Epilepsy | 2 | 5.6 | Tying |
| Python       | Python spp. | Bone | Rabies and swelling | 3 | 8 | Tying and Banding |
|              |             | Tail and bone | Cancer and swelling | 3 | 8 | Banding |
|              |             | Fat             | Wound and ear disease | 7 | 19 | Banding, Anointing |
|              |             | Meat            | Rabies, foot crack, and ear disorder | 13 | 36 | Eating, Anointing |
| Tortoise     | Testudo graeca | Teeth | Swelling | 3 | 8 | Heating |
|              |             | Shell           | Trypanosomiasis, nose bleeding | 6 | 17 | Fumigation |
| Chameleon    | Chamaelea chamaeleon | Whole body | Cancer, body fattening | 6 | 17 | Tying |
| Lizard       | Lacertilia spp. | Whole body | Dry cough and anemia | 3 | 8 | Drinking |
| Fish         | Any fish spp. | Meat | Rheumatism | 4 | 11 | Eating |
|              |             | Bile            | Eye disorder | 3 | 8 | Eating |
| Arthropods   | Scorpion    | Palamnaeus swammerdami | Meat | Scorpion bite | 6 | 17 | Massaging |
| Bee          | Apis mellifera | Honey | Wart, asthma, diarrhea, throat pain, stomachache, cough, TB, mumps, heart failure | 35 | 97 | Eating, drinking |
| Termite (Queen) | All spp. | Larvae | Stomach disorder | 3 | 8 | Drinking |
| Field cricket | Gryllus campestris | Whole body | Fattening of livestock | 3 | 8 | Eating |
| Gnat (small insect) | All spp. | Whole body | Eye disease | 3 | 8 | Eating |
| Bumble bee   | Bombus spp. | Honey | Stomachache, eye disorder, and coughing | 13 | 36 | Eating |
| Ticks        | All tick spp. | Blood | Fungal disease on the skin | 3 | 8 | Anointing |
This study showed that traditional medicines were administrated by drinking, eating, anointing, tying, branding, fumigation, and massaging. The study conducted by Gidey Yirga et al. showed most of traditional medicines were administrated orally and through dermal. Fumigating materials such as smokes were also entering into the body using nasal opening to treat different ailments. Some parts of animals such as bones, skin, and teeth were believed to be medicine by tying on the neck or other parts of the body [27].

The majority of the remedy preparations did not have additive substance while the remaining had different additive substances like sugar, water, butter, honey, teff and millet flour salt, spice, milk, egg, and coffee. The result of this study is similar to research conducted by Gidey Yirga et al. [27]. Haileselasie stated that many animals were used for the treatment of multiple ailments singly or in combinations with other animal products or/and plants like seeds, flowers, latex (resins in some cases), and roots [22].

The honey of bee species (Apis mellifera) is known to relieve wart, asthma, diarrea, throat pain, stomachache, cough, and tuberculosis and achieves the highest fidelity level, whereas biles of common fox (Canis spp.) to cure eye problem and toothache, upper coats of snake (Naja naja) to cure headache, and teeth of crocodile (Crocodylus spp.) to cure epilepsy have the lowest fidelity level. On the other hand, Jaroli et al. stated that the uses of animals that are commonly known by the Garasiya informants have higher fidelity levels than less common known species [27]. He reported the cooked flesh of bat (Cynopterus sphinx) used to relieved cough and fever has the highest FL followed by blood of pigeon (Columba livia) to treat paralysis and urine of cow (Bos taurus) for wound healing, while the flesh of the pig (Sus scrofa) to relieve muscular pain and elephant (Elephas maximus) for pimples have the lowest fidelity level.

The finding of this study suggested that the traditional zootherapeutic remedies followed by the native people of Metema Woreda plays an important role in their primary healthcare. The documentation of this indigenous knowledge on animal-based medicines should be very helpful in the formulations of strategies for sustainable management and conservation of bio-resource as well as providing potential for novel drug discoveries [21].

Conclusions
The result shows that animals and their parts/products occupy key positions in the traditional medicine and medical practices to treat different ailments. Whole bodies or parts/products of traditional medicinal animals were used as a medicine. It was obvious that the members of the local communities studied possessed considerable knowledge related to preparation, administration, parts/products used, ingredients added, and other issues of traditional remedies. However, efforts to document, conserve, and manage the indigenous knowledge and skill were very scarce, and important indigenous knowledge is getting lost together with the elders and experts. Hence, it is important to document, conserve, and manage the indigenous knowledge, and further research should be done to test the products scientifically for product development.

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Availability of data and materials
The data used and analyzed during the current study is available from the corresponding author on a reasonable request, without disclosure of the interviewees.

Declarations
We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

Authors’ contributions
FA, SA, and MA proposed the research idea and collected the data from the respondents. FA organized the data in computer, did the analysis, interpretation, and identification, and wrote the manuscript. SA and MA revised the manuscript for scientific content and did the language check. All authors read and approved the final manuscript.

Ethics approval and consent to participate
The ethics approval is not applicable. Written consent by the authors was obtained before the interviews. We explained the objectives of the research to each respondent, when we also had a chance to answer questions and clear doubts. We assured them that their information was anonymous and that it was only for research purposes.

Consent for publication
This manuscript does not contain any individual person’s data, and further consent for publication is not required.

Competing interests
The authors declare that they have no competing interests.

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