

# Documentation of Traditional Knowledge Associated with Medicinal Animals in West Gojjam Zone of Amhara Region, Ethiopia

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## Research

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## Abstract

**Background** In Ethiopia, Ethnozoology and Zootherapeutic research is very limited and little attention has been given. The study was designed to investigate and document traditional knowledge associated with medicinal animals in West Gojjam Zone of Javitenan, North Achefer, and Bahir Dar Zuria districts.

**Methods** Ethnozoological data were collected using structured questionnaires and use value (UV), informant consensus factor (ICF), fidelity level (FL), preferential ranking, and paired comparison were analyzed.

**Results** A total of 26 animal species and were identified and recorded as a source medicine to treat 33 types of ailments. Animal derived medicines of *Bos indicus*, *Trigona* spp. and *Apis mellifera* were frequently reported species to treat various ailments. *Bos indicus*, *Trigona* spp., *Apis mellifera*, *Hyaenidae carnivora*, and *Labeobarbus* spp. were the most frequent use value reports (84%, 52%, 43%, 37% and 36%) respectively. Informants reported 25 animal parts to treat ailments. Honey and meat took the highest frequency use report followed by purified butter, Milk, Liver, fatty meat and Cheese stored more than 7 year were described with average ICF value of 69%. Maximum degree of consensus was developed for remedy of evil eye (88%) followed by dry cough, swelling and hepatitis 82% each. Use of animal derived medicine from *Liotrigona* spp. used to relive dry-cough tend to have the highest FL (80%); followed by *Labeobarbus* spp. for swelling (33%) and *Trigona* spp. for dry-cough (30%). Paired comparisons revealed that purified butter > 2 year, Cheese > 7 year, honey of *Liotrigona* spp. (Yetinign Tazma), and honey of *Trigona* spp. (Tazma) were the most popular and efficacious animal-derived medicines to cure malaria and ranked 1st, 2nd, 3rd and 4th, respectively.

**Conclusion and recommendation** results of this study recorded the most popular animal derived medicine to cure various ailments. Thus, government must strengthen traditional healers with training, club formation, material and financial support and improve means of protecting their intellectual property rights. Moreover, chemists and pharmacists should be undergo a detailed study to identify which chemical constituent of animal and animal product is responsible for the respective treatment of ailments in the study area.

## Background

Traditional Medicine has been practiced for several thousand years in different parts of the world particularly where large ethnic communities live in. Currently, more than 80% of the world population uses traditional medicine either on its own or as a complementary medicine [1]. More than 80% of the population in Sub-Saharan Africa relies on traditional medicines and Traditional Health Practitioners (THPs) as the primary source of health care [2]. Like in many other developing countries, more than 70% of human and 90% of livestock population primarily depend on traditional medicine in Ethiopia [3].

The World Health Organization (WHO) defined traditional medicine (TM) as the sum total of all knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experiences and observations handed from generation to generation, whether verbally or in writing [4]. The term TM covers traditional healers and their use of plant materials, animal origins and inorganic mineral substances for health care in the context of social, cultural and religious backgrounds [5]. The dynamic relationship between human culture or societies, and animal resources in their environment can be studied in the field of ethnozoology [6]. Zootherapy is an important component of ethnozoology, involves the healing of human ailments by using therapeutic based on medicine obtained or ultimately derived from different animals [7].

Use of animal parts for the treatment of ailments affecting both humans and livestock has a long and rich history [8]. Wild and domestic animals and their by-products such as hooves, skins, bones, feathers, and tusks were important ingredients in the preparation of curative, protective and preventive measures in various cultures [9, 10, 8]. There is

varied and richer utilization of animals for illnesses in Latin America and Africa with a long period of traditional practices of animal remedies for all kinds of ailments [11]. Whole, part or products of animal species such as scales of the tree pangolin species are used for the treatment of a wide range of human ailments in Ghana [1].

In Ethiopia, like in the rest of the world, research on ethnozoology is very limited, and only little attention has been given for zootherapeutic research. As [12] noted that though medicinal animals are widely used in different countries for health care, it is little researched when compared to medicinal plants. Only some researches like [13] tried to list around 23 animals used for the treatments of human diseases in Ethiopia. As [14] reported the use of different parts and products of 16 species of medicinal animals such as bile, milk, blood, pancreas, urine, hair and fecal matter in order to treat 18 different human ailments from Kunama in Kafta-Humera district. As [15] reported the use of various vertebrate and invertebrate, wild and domestic, taboo and edible animals in various forms such as meat, urine, feces, bone, skin, blood, fat, honey, milk, butter, bile, egg, etc. to treat various kinds of human ailments such as TB, rabies, impotence (sexual), asthma, snake biting, pellagra, evil eye, etc. and external pathologies like wounds and skin diseases from Gendewuha and Kumeraaftit people of Metema district. Moreover the study from [16] reported a total of 21 animal species were recorded to treat 46 different types of ailments in Amaro district of Southern Nations and Nationalities People Regional State of Ethiopia.

The traditional knowledge of traditional healing practices using animals is now disappearing very rapidly due to modernization [17]. This loss of traditional knowledge has an impact on 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 [18]. Traditional healers in Ethiopia hold their indigenous knowledge in secret and little information has been recorded by few authors [19]. Therefore, the current paper reports the result of a study of the traditional knowledge associated with medicinal animals in West Gojjam Zone of Amhara Region, Ethiopia. The investigation and documentation of TK in medicinal animals of the area is very valuable in the development of pharmaceutical compounds for bioprospecting, and also very helpful in making strategies for sustainable utilization of natural resources and conservation of biodiversity. The objective of this study was to investigate and document traditional knowledge associated with medicinal animals and medicinal animals used by traditional healers in West Gojjam Zone.

## Materials And Methods

Description of the study area

### i. Location

The study was conducted in West Gojjam zone, North West of Ethiopia particularly in Javitenan, North Achefer, and Bahir Dar Zuria districts in which practice, distribution, and use of medicinal plants and animals are high. West Gojjam zone is one of the 10 zones in Amhara Region and lies between 36° 30' to 37° 5' Longitudes East and 10°16' to 11°54' Latitudes North [20]. The total population is estimated as 2,106,596 and more than 91% of the people lived in rural areas [21]. Agriculture is the main source of livelihood for the community. Administratively, West Gojjam zone is divided into 13 rural districts and 5 town administrations [22]. The total land area of West Gojjam zone is 13,280 km<sup>2</sup>. Its elevation varies from 1500 to 3500 m.a.s.l. Most of the districts (75%) in the zone have ambient temperature ranging from 15–20°C and the remaining has 20–27°C [23].

### ii. Population

The study areas, namely North Achefer, Bahir Dar Zuria and Jabitenan districts, are among three of the 14 districts found in West Gojam zone. North Achefer is bordered in the North by Lake Tana; in the South by South Achefer; in the

West by the North Gondar zone; in the East by Bahir Dar Zuria; and in the Southeast by Mecha. According to the Central Statistical Agency of Ethiopia [21] this district has a total population of 189,716. The majority of the inhabitants (99.05%) practiced Ethiopian Orthodox Christianity religion. Bahir Dar Zuria borders in the South by Yilmana Densa; in the Southwest by Mecha; in the Northwest by the Lesser Abay River which separates it from North Achefer; in the North by Lake Tana (On the shores of Lake Tana situates the city and special zone of Bahir Dar); and in the East by the Abay River which separates it from the South Gondar zone. Based on the [21] this district has a total estimated population of 182,730. Jabitenan borders in the Southeast by Dembecha; in the West by Bure; in the Northwest by Sekela; in the North by Quarit; and in the East by Dega Damot districts. According to [21] the district has a total estimated population of 179,342. The three districts have long been inhabited by people who have an age-old tradition of using medicinal animals and plants to treat human and livestock ailments.

## Data collection

The study zone, districts and Kebeles were selected purposively based on the availability of traditional medicine practitioner following the information obtained from literatures and information from zonal and district health bureaus of Amhara Region. Three districts from a zone and three representative Kebeles from each district, namely: Jiga-Yelimodar, Mankusa-Abdegoma and Abasime-Zegay from Javitenan; Yismala-Jankit, Liben-Dankura and Sankra from North Achefer; and Wenidata, Yegoma-Huletu and Gomibat from Bahir Dar Zuria; were selected. Then, on average, 9 respondents (traditional medicine practitioners) and 2 key informants (traditional healers) were selected from each Kebele. The informants were selected based on their experience, recognition as traditional healer, knowledge of healing practice and age. Ethno-zoological data were collected using semi-structured questionnaires. The questions were prepared in English, translated into a local language and administered through interviews. For each ethno-zoological medicine, the target groups were asked to explain its therapies, preparation methods, diseases claimed to be treated, parts of animals used, routes of administration, and the local name of the species. The information regarding the use of a particular animal for a specific disease was treated as one user report.

## Data analysis

The ethno-zoological data were analyzed using SPSS version 21 and Microsoft Excel spreadsheet was used to analyze use value, informant consensus factor, fidelity level, preferential ranking, and paired comparison.

*A. Use value (UV):* was calculated for individual animal to give a quantitative measure of its relative importance to the informant objective.

$UVs = \sum_i UV_{is} / n$ ; where: UV = the use value of a species

$UV_i$  = number of use reports cited by the informants for that particular species

N = total number of respondents interviewed

*B. Informant consensus factor (ICF):* was calculated to determine the homogeneity of the informant for a particular animal to treat a particular ailment.

$ICF = (N_{ur} - N_t) / (N_{ur} - 1)$ ; where:

$N_{ur}$  = total number of use reports for a particular illness category

$N_t$  = total number of species used for this illness category

*C. Fidelity level (FL):* was calculated to express the preference of a species to other species in the management of a particular ailment

$FL = (I_p/I_u)*100$ ; where:

$I_p$  = the number of informants stating the use of a species for a particular ailment category

$I_u$  = number of informants stating the use of that species for any sort of ailment category

*D. Preferential ranking:* was made to rank the popular medicinal animals according to their healing capacity of certain ailments. The popular medicinal animal was ranked by the selected informants. Informants were oriented and asked to mark the highest value for most preferred and 1 for the least preferred medicinal animal to treat malaria, rabies, hepatitis, dry cough, epilepsy, arthritis and asthma. Then summed up values, ranked and illustrated in tables.

*E. Paired comparison:* was used to evaluate the degree of preference of the selected medicinal animals reported from the study area to treat a certain disease. A list of pairs of selected items with all possible combinations was made; and the sequence of the pairs and the order within each pair was randomized and presented to selected informants and their responses were recorded; and total scores were summed up using the  $n(n-1)/2$ ; where  $n$  = the number of medicinal animals being compared. The data were summarized using descriptive statistics and presented by percentages, frequency distribution, tables, charts and graphs.

## Results And Discussion

### Demography

A total of 83 informants 85.9% males and 14.1% females and 18 key informants were interviewed with an average age of  $50 \pm 11$ . Regarding their educational status 49.4% of the informants were unschooled while the remaining 50.6% had attended either primary or secondary school educations Table 1.

Table 1: Socio-demographic characteristics of the informants in the study area

| Variables   | Name of the Variables | Frequency | Percent (%) |
|-------------|-----------------------|-----------|-------------|
| District    | Jabitenan             | 28        | 33.7        |
|             | Semen Achefer         | 30        | 36.1        |
|             | Bahir Dar Zuria       | 25        | 30.1        |
| Kebele      | Mankusa-Abdegoma      | 9         | 10.8        |
|             | Jiga-Yelimodar        | 9         | 10.8        |
|             | Abasem-Zegay          | 10        | 12.0        |
|             | Sankra                | 10        | 12.0        |
|             | Liben-Dankura         | 10        | 12.0        |
|             | Yismala-Jankti        | 10        | 12.0        |
|             | Yigoma-Huletu         | 9         | 10.8        |
|             | Wenidata              | 8         | 9.6         |
|             | Gomibat               | 8         | 9.6         |
| Educational | Illiterate            | 21        | 25.3        |
| Status      | Informal education    | 20        | 24.1        |
|             | 1-4                   | 15        | 18.1        |
|             | 5-8                   | 24        | 28.9        |
|             | 10-12                 | 3         | 3.6         |

### Common Diseases Claimed by informants

Informants' claimed, Malaria and Trypanosomiasis was the most troublesome human and animal health problems of the study districts respectively Fig. 2. However, viral diseases of the humans and foot and mouth diseases of the animal are the least reported health problems in the study districts. According to [24] report 61% of the zone area was exposed to malaria and 30% to Trypanosomiasis.

### Medicinal animals and use value reports

In this study a total of 26 animal species were identified and recorded as a source medicine to treat 33 ailments. Animal derived medicines of *Bos indicus*, *Trigona spp.* and *Apis mellifera* were frequently reported species to treat various ailments. Moreover, *Procavia capensis*, *Labeobarbus spp.* and *Hyaenidae carnivora* and other animal derived medicines were also used to treat different ailments (Table 2.). Based on [15] study of 24 animals had been recorded and used as sources of remedies in Metema district of Gendewuha and Kumeraaftit kebeles as a traditional medicine.

Use value report of the 83 informants showed that *Bos indicus*, *Trigona spp.*, *Apis mellifera*, *Hyaenidae carnivora*, and *Labeobarbus spp.* were the most frequent use value reports (84%, 52%, 43%, 37% and 36%), respectively. However Tortoise, Spider and Guinea fowl were the least use value report of animal species (4%, 4% and 2%) respectively as shown in Table 2. Higher use value of animal traditional medicine indicate that particular animal species are used by

large number of people while a lower use value show that the respondents disagree on the use of that particular animal species for the treatment of ailment [25].

Table 2: Medicinal animal species used by traditional animal medicine practitioner and its use value reports of individual animal species based on its relative importance

| No | Species Name/Animal taxon     | English Name  | Local Name    | $\sum iUVis$ | UV   | %UV |
|----|-------------------------------|---------------|---------------|--------------|------|-----|
| 1  | <i>Clarias gariepinus</i>     | Catfish       | Ambaza assa   | 4            | 0.05 | 5   |
| 2  | <i>Potamochoerus larvatus</i> | Bush pig      | Asama         | 10           | 0.12 | 12  |
| 3  | <i>Bos indicus</i>            | Cattle        | Ykenede Kbite | 70           | 0.84 | 84  |
| 4  | <i>Equus asinus</i>           | Donkey        | Aheya         | 4            | 0.05 | 5   |
| 5  | <i>Gallus domesticus</i>      | Chicken       | Doro          | 14           | 0.17 | 17  |
| 6  | <i>Capra hircus</i>           | Goat          | Fiyel         | 15           | 0.18 | 18  |
| 7  | <i>Hystrix cristata</i>       | Porcupine     | Jart          | 10           | 0.12 | 12  |
| 8  | <i>Hyaenidae carnivora</i>    | Hyena         | Jib           | 31           | 0.37 | 37  |
| 9  | <i>Phacochoerus africanus</i> | Warthog       | Kerkero       | 17           | 0.2  | 20  |
| 10 | <i>Phyllophaga spp.</i>       | White grub    | Qimburs       | 5            | 0.06 | 6   |
| 11 | <i>Perdix perdix</i>          | Partridge     | Qoqe          | 10           | 0.12 | 12  |
| 12 | <i>Silvicoepa grimmer</i>     | Antelope      | Midako        | 4            | 0.05 | 5   |
| 13 | <i>Panthera pardus</i>        | Leopard       | Nebir         | 4            | 0.05 | 5   |
| 14 | <i>Labeobarbus spp.</i>       | White fish    | Nech asa      | 30           | 0.36 | 36  |
| 15 | <i>Apis mellifera</i>         | Honeybee      | Nib           | 36           | 0.43 | 43  |
| 16 | <i>Lopus starkii</i>          | Rabbit        | Tinchel       | 4            | 0.05 | 5   |
| 17 | <i>Procavia capensis</i>      | Wood chuck    | Shikoko       | 17           | 0.2  | 20  |
| 18 | <i>Trigona spp.</i>           | Stingless bee | Tazma Nib     | 43           | 0.52 | 52  |
| 19 | <i>Liotrigona spp.</i>        | Stingless bee | Tinign        | 15           | 0.18 | 18  |
| 20 | <i>Chiroptera spp.</i>        | Bat           | Yeletit wof   | 10           | 0.12 | 12  |
| 21 | <i>Python sebae</i>           | Python        | Zendo         | 9            | 0.11 | 11  |
| 22 | <i>Papio anubis</i>           | Baboon        | Zinjero       | 6            | 0.07 | 7   |
| 23 | <i>Numida meleagris</i>       | Guineafowl    | Jigra         | 2            | 0.02 | 2   |
| 24 | <i>Testudinidae</i>           | Tortoise      | Eli           | 3            | 0.04 | 4   |
| 25 |                               | Snake         | Ebab          | 5            | 0.06 | 6   |
| 26 |                               | Spider        | Shererit      | 3            | 0.04 | 4   |

### Animal Parts to be used for medicinal Purpose

A total of 25 animal parts and products were reported by informants to treat 33 types of ailments (Fig. 3). Among the total frequency of use report (381), honey and meat took the highest frequency of use report followed by butter (purified

butter), milk, liver, fatty meat and cheese (stored more than 7 year) were described Figure 3 and some of them were mixed during preparation. Based on [15] animal body parts used as remedy of human diseases include fat, honey, milk, butter, urine, feces, meat, skin, bones, bile, liver, eggs, horn, etc. and some of these animal medicines need a mix during preparation [16].

#### Storage conditions of prepared Animal Traditional Medicines

Most of the informants (77.1%) stored animal-derived traditional medicines in a clean area, 7.2% stored in a dry area using glass and 3.6% stored in a cold area with or without glass. However, 8.4% of the informants did not store animal derived traditional medicine. This indicates that the Informants had traditional knowledge of storing animal-derived medicine in a clean area. This understood that traditional medicines derived from animals were more perishable than those medicines derived from plants. Therefore, animal-derived traditional medicines need proper sanitation and protection to enhance their shelf life.

#### Informants' consensus

Based on the informants' report of remedial action, 12 of the most reported ailments were calculated as an informant consensus factor (ICF). Results showed that average ICF value of 69%. The maximum degree of consensus was developed for remedy of evil eye (88%) followed by dry cough, swelling and hepatitis 82% each Table 3. However, Hemorrhoids was the minimum ICF value remedy which is 40%. Informant consensus values below the average ICF value indicate that treatment of a particular ailment was in different animal parts and/or products, which implies heterogeneity of use reports (Table 3).

Table 3: ICF value of 12 selected ailment of treatments with animal derived medicines

| Disease Category          | Nur | Nt | ICF  |
|---------------------------|-----|----|------|
| Abdomenal pain            | 24  | 8  | 0.70 |
| Asthma                    | 12  | 5  | 0.64 |
| Dry cough                 | 40  | 8  | 0.82 |
| Epilepsy                  | 13  | 7  | 0.50 |
| Hepatitis                 | 12  | 3  | 0.82 |
| Arthritis                 | 27  | 8  | 0.73 |
| Malaria                   | 25  | 8  | 0.71 |
| Rabies                    | 9   | 3  | 0.75 |
| Swelling                  | 34  | 7  | 0.82 |
| Wound                     | 22  | 11 | 0.52 |
| Hemorrhoids               | 6   | 4  | 0.40 |
| Evil-eye                  | 27  | 4  | 0.88 |
| $\Sigma$                  |     |    | 8.29 |
| ICF value ( $\Sigma/12$ ) |     |    | 0.69 |

#### Fidelity level

The ethno-zoological uses of animals that are commonly known by the informants have higher fidelity level as shown in Fig. 4. Use of animal derived medicine from *Liotrigona spp.* used to relive dry-cough tend to have the highest FL (80%); followed by *Labeobarbus spp.* for swelling (33%) and a product obtained from stingless bees *Trigona spp.* for dry-cough (30%).

### Preferential ranking

Preferential ranking was conducted to show the preference of one medicinal animal and its parts to the other. This can be conducted when different species used for the same illness. Based on 18 key informants report of 9 animal-derived medicines used to cure malaria, Processed products of *Bos indicus* (Cheese  $\geq$  7 year and Purified Butter  $\geq$  2 year) were ranked 1st and 2nd respectively Table 6 in the appendix. Therefore, both are used as an effective traditional medicine to cure Malaria. Moreover, 'Tazma' honey of *Trigona spp.*, honey of *Apis mellifera*, 'Tazma' honey of *Liotrigona spp.*, Bile of *Capra hircus*, meat of *Labeobarbus spp.*, and meat of *Phacochoerus africanus* were ranked 3rd, 4th, 5th, 6th, 7th, and 8th respectively. However meat of helmeted guinea fowl was the least preferred animal derived medicine to cure malaria Table 6. Moreover, dry Cough was treated by seven animal derived medicines. Out of these, chicken egg is the most preferred animal-derived medicine and ranked 1st. Larva and honey of honeybees and 'Tazma' honey of *Trigona spp.* ranked 2nd as shown in Table 7 in the appendix. However, whey of cow milk was the least preferred animal-derived medicine to treat dry Cough. Key informants' reported of eight species of animal derived medicines to treat Arthritis. These were meat of *Phacochoerus africanus*, meat of *Labeobarbus spp.* and meat of *Potamochoerus larvatus* ranked 1st, 2nd and 3rd respectively. However, meat of *Procavia capensis* was the least preferred animal derived medicine to treat Arthritis Table 4.

Table 4: Preferential ranking of 8 animal derived medicines to treat Arthritis based on 18 key informants

| Respondents | <i>Apis Mellifera</i> | <i>Phacochoerus africanus</i> | <i>Labeobarbus spp.</i> | <i>Potamochoerus larvatus</i> | <i>Hystrix cristata</i> | <i>Bos indicus</i> | <i>Clarias gariepinus</i> | <i>Procavia capensis</i> |
|-------------|-----------------------|-------------------------------|-------------------------|-------------------------------|-------------------------|--------------------|---------------------------|--------------------------|
| R 1         | 4                     | 5                             | 8                       | 6                             | 2                       | 3                  | 7                         | 1                        |
| R 2         | 6                     | 3                             | 7                       | 4                             | 2                       | 5                  | 8                         | 1                        |
| R 3         | 8                     | 1                             | 7                       | 4                             | 2                       | 5                  | 6                         | 3                        |
| R 4         | 5                     | 8                             | 4                       | 6                             | 2                       | 1                  | 7                         | 3                        |
| R 5         | 2                     | 8                             | 6                       | 3                             | 4                       | 1                  | 7                         | 5                        |
| R 6         | 5                     | 8                             | 7                       | 6                             | 2                       | 1                  | 3                         | 4                        |
| R 7         | 1                     | 8                             | 7                       | 6                             | 4                       | 2                  | 5                         | 3                        |
| R 8         | 1                     | 8                             | 7                       | 6                             | 5                       | 2                  | 3                         | 4                        |
| R 8         | 6                     | 8                             | 7                       | 5                             | 1                       | 4                  | 3                         | 2                        |
| R 9         | 3                     | 8                             | 2                       | 5                             | 1                       | 4                  | 7                         | 6                        |
| R 10        | 4                     | 8                             | 5                       | 7                             | 2                       | 3                  | 6                         | 1                        |
| R 12        | 5                     | 7                             | 8                       | 6                             | 3                       | 1                  | 2                         | 4                        |
| R 13        | 5                     | 6                             | 8                       | 7                             | 4                       | 1                  | 2                         | 3                        |
| R 14        | 6                     | 5                             | 4                       | 8                             | 7                       | 3                  | 1                         | 2                        |
| R 15        | 8                     | 5                             | 1                       | 6                             | 7                       | 3                  | 2                         | 4                        |
| R 16        | 8                     | 6                             | 5                       | 4                             | 3                       | 7                  | 2                         | 1                        |
| R 17        | 4                     | 8                             | 2                       | 6                             | 7                       | 3                  | 1                         | 5                        |
| R 18        | 6                     | 8                             | 5                       | 2                             | 3                       | 7                  | 4                         | 1                        |
| Total       | 87                    | 118                           | 100                     | 97                            | 61                      | 56                 | 76                        | 53                       |
| Rank        | 4 <sup>th</sup>       | 1 <sup>st</sup>               | 2 <sup>nd</sup>         | 3 <sup>rd</sup>               | 6 <sup>th</sup>         | 7 <sup>th</sup>    | 5 <sup>th</sup>           | 8 <sup>th</sup>          |

### Paired comparison

Paired comparison of 6 medicinal animal species was used to indicate the efficacy and popularity of animal-derived medicines to treat malaria as shown in Table 5. The result of paired comparisons revealed that purified butter  $\geq$  2 year, Cheese  $\geq$  7 year, 'YetinignTazma' honey of *Liotrigona spp.*, and 'Tazma honey' of *Trigona spp.* were the most popular

and efficacious animal-derived medicines to cure malaria and ranked 1st, 2nd, 3rd and 4th, respectively. However, bile of goat (*Capra hircus*) and meat of white fish (*Labeobarbus spp*) were the least popular and efficacious animals to cure malaria.

Table 5: Paired comparison of 6 animal derived medicines for the treatment of Malaria based on 18 key informants

| Respondents | <i>Bos indicus</i><br>(Cheese $\geq$ 7year) | <i>Capra hircus</i><br>(Bile) | <i>Liotrigona spp.</i><br>(Yeteneqn Tazma) | <i>Bos indicus</i><br>(Purified Butter $\geq$ 2year) | <i>Trigona spp.</i><br>(Tazma honey) | <i>Labeobarbus spp.</i> (Meat) |
|-------------|---|-------------------------------|--|--|--------------------------------------|--------------------------------|
| R 1         | 1   | 2                             | 4  | 5  | 3                                    | 0                              |
| R 2         | 2   | 3                             | 1  | 4  | 5                                    | 0                              |
| R 3         | 2   | 1                             | 4  | 5  | 0                                    | 3                              |
| R 4         | 3   | 3                             | 0  | 5  | 2                                    | 2                              |
| R 5         | 3   | 4                             | 0  | 5  | 2                                    | 1                              |
| R 6         | 2   | 2                             | 4  | 5  | 2                                    | 0                              |
| R7          | 4   | 0                             | 2  | 5  | 2                                    | 2                              |
| R8          | 1   | 4                             | 2  | 2  | 4                                    | 2                              |
| R8          | 4   | 5                             | 2  | 3  | 0                                    | 1                              |
| R9          | 3   | 1                             | 0  | 5  | 2                                    | 4                              |
| R10         | 3   | 0                             | 3  | 5  | 3                                    | 1                              |
| R 12        | 1   | 5                             | 2  | 3  | 0                                    | 4                              |
| R 13        | 3   | 1                             | 4  | 5  | 0                                    | 2                              |
| R 14        | 3   | 1                             | 4  | 0  | 5                                    | 2                              |
| R 15        | 4   | 0                             | 3  | 2  | 5                                    | 1                              |
| R 16        | 5   | 0                             | 4  | 1  | 3                                    | 2                              |
| R 17        | 5   | 4                             | 2  | 1  | 3                                    | 0                              |
| R 18        | 7   | 2                             | 3  | 1  | 2                                    | 0                              |
| Total       | 56  | 38                            | 44   | 62   | 43                                   | 27                             |
| Rank        | 2 <sup>nd</sup>                             | 5 <sup>th</sup>               | 3 <sup>rd</sup>                            | 1 <sup>st</sup>                                      | 4 <sup>th</sup>                      | 6 <sup>th</sup>                |

#### Informants Attitude on the Conservation Aspects of Animal Traditional Medicine

More than half of the informants (61.4%) reported the current status of medicinal animals' as rare to obtain them and 38.6% of them perceived their status in declining state. The informants also reported the demand for seeking medicinal animals to treat ailments as rare (74.7%), increasing (20.5%), and decreasing (4.8%). Informants listed some of the threats that caused the decline of medicinal animals such as deforestation, hunting, climate change, agricultural expansion and shortage of forage, overexploitation of animal genetic resources, lack of modern medication, lack of shelter and lack of awareness. Based on the report of [26] extinction, overhunting, habitat loss/degradation/fragmentation, invasion of non-native species, pollution, and climate change as main threats of global biodiversity. There is massive loss of wildlife across the globe due to over-hunting [27]. Therefore, informants practiced different techniques to conserve medicinal animals. For instance, 80.7% conserve animal traditional medicine by protecting the forests which are shelters of medicinal animals. Moreover, prevention of hunting, application of breeding, and raising awareness of the local people about medicinal animals be also practiced to conserve medicinal animals.

Informants reported modernization had a negative impact on the application and use of animal-derived traditional medicine. Because, experts abuse traditional healers as well as users to ban preparation and use of animal-derived traditional medicine and they consider it as a folk medicine. Thus, modernization made local peoples to forget the knowledge of animal derived medicine. As [17] noted knowledge of traditional healing practices using animals is fast disappearing due to modernization. This showed that loss of traditional knowledge has much impact on the development of modern medicine [14].

#### Inheritance of healing wisdom

Informants who practice Animal derived traditional medicine to treat ailments inherited the traditional knowledge from their parents, particularly fathers (47%), mothers (14.5%), and grandfathers, grandmothers and brothers (10.8%). Moreover, 12% of the informants inherited the animal traditional knowledge from friends, community neighbours, monks and nephews. However, 15.7% of the informants did not want to reveal the sources of their knowledge of animal derived traditional medicine. Informants (94%) showed willingness to inherit the knowledge of animal traditional medicine to their daughters (56.6%), sons (12%), families (8.4%), friends (2.4%) and researchers (1.2%). In addition 13.3% of the informants showed willingness to inherit the knowledge of animal-derived traditional medicine to any interested person. However, 6% of the informants did not want to inherit the traditional knowledge of medicinal animals to any person. Traditional healers in Ethiopia held their indigenous knowledge in secret [19] and showed interest to pass on the animal-derived traditional medicinal knowledge orally only to their eldest son, at their old age [28]

#### Attitude of urban inhabitants towards use of traditional medicine

A total of 57 individuals (73.3% males and 26.3% females) of urban dwellers were interviewed to assess the use of traditional medicine derived from animals, of which, 43.9% were district Livestock and Fishery expertise including animal health experts, 29.8% are extension agents and 26.3% were district health expertise and officers.

Out of the total traditional medicine users of urban inhabitants, 56.1% used traditional medicine for treating ailments. However, 43.9% did not use traditional medicine for treating ailments. The reason of not using traditional medicines for treating ailments were the unknown dose of medicine used for treatment, doubts about the safety of the treatment and efficacy of traditional medicine. Moreover, the non-apparent use, availability and accessibility of the traditional medicine to one's dwelling place limit the preference of using them as a traditional medicine.

Users of urban inhabitants (42.1%) used traditional medicine derived from both plants and animals, (12.3%) from plants only and (1.8%) from animals only. The reason of using much more traditional medicines derived from plants than animals was because of the fact that most of the world modern medicines are mostly derived from plants, and science affirmed their efficacy in laboratories. Besides plant-derived traditional medicines were easily accessible and had lower price than modern medicines and easily available. Users of animal-derived traditional medicine reasoned that animal remedies were natural, harmless, fast to treat, used as an ingredient in combination with other plant medicines and some of them are available on markets such as honey, butter, fish, milk, egg, liver and Tazma honey. 26.3% of urban user inhabitants reported traditional animal medicines were sold for treating ailments such as evil eye, hepatitis, asthma, wound and sexual disorders.

The knowledge of Zoonotic diseases was assessed in urban inhabitant users of animal derived traditional medicine. Users 84% knew and listed Zoonotic diseases such as Rabies, Brucellosis, Tuberculosis, Anthrax and Black leg. This indicates urban inhabitants were more educated than the rural ones. However, 16% of them did not know about zoonotic diseases. Urban inhabitant users described major challenges on the use of animal-derived traditional medicine as follows: 22.8% described the challenge was a shortage of supply, 17.5% declared as lack of knowledge, 10.5% reported sanitation problems, and others listed the challenge was the dose of animal-derived medicine used for treatment is unknown and religious restriction on some of animal derived traditional medicine. Moreover, lack of scientific research and decline of traditional healers were stated as the main challenges by some of the users. Among the challenges a shortage of supply is due to over hunting of animals, deforestation and climate change.

## Conclusion And Recommendation

Ethiopia is rich in biological resources and home to different ethnic groups, many of which have adopted various techniques to protect their health care systems and uses traditional medicine derived from plants and animals. Animal

derived medicines are an alternative to treat ailments in rural areas. Thus, results of this study revealed 25 parts and/or products of 26 animal species were used as a traditional medicine to treat 33 ailments in the study area. Moreover, this study recorded the most popular animal derived medicine to cure various ailments. However, the status of medicinal animals and the demand of seeking medicinal animals were rare due to different factors. Besides urban dwellers of government employees were recorded as users of animal-derived traditional medicine.

The following recommendations are drawn from the study

- Government must strengthen traditional healers with training, club formation, material and financial support and improve means of protecting their intellectual property rights. Moreover, continual awareness-raising and training should be given to the community of the study area in order to avoid egocentric and abusive behavior and to enhance the participatory role of the local people regard to issues of traditional medicinal knowledge.
- Researchers such as chemists and pharmacists should be undergo a detailed study in order to identify which chemical constituent of animal and animal product is responsible for the respective treatment of ailments in the study area.

## Declarations

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### Competing interest statement

- The authors declare that they have no competing interests.

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## Appendix

Table 6: Preferential ranking of 9 animal-derived medicines to treat Malaria based on 18 key informants

| Spp. Name                     | Parts used                    | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | R13 | R14 | R15 | R16 | R17 | R18 | Total | Rank            |
|-------------------------------|-------------------------------|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----------------|
| <i>Bosindicus</i>             | Cheese $\geq 7$ year          | 6  | 4  | 3  | 8  | 9  | 9  | 8  | 9  | 8  | 9   | 5   | 5   | 6   | 7   | 9   | 9   | 9   | 9   | 132   | 1 <sup>st</sup> |
| <i>Apismellifera</i>          | Honey                         | 8  | 6  | 7  | 7  | 8  | 4  | 2  | 2  | 5  | 6   | 3   | 3   | 4   | 9   | 5   | 8   | 8   | 6   | 101   | 4 <sup>th</sup> |
| <i>Labeobarbus spp.</i>       | Meat                          | 5  | 7  | 4  | 2  | 5  | 2  | 5  | 7  | 6  | 5   | 8   | 8   | 3   | 3   | 3   | 3   | 4   | 2   | 82    | 7 <sup>th</sup> |
| <i>Phacochoerus africanus</i> | Meat                          | 1  | 2  | 2  | 1  | 3  | 3  | 3  | 5  | 4  | 2   | 7   | 1   | 9   | 1   | 2   | 2   | 1   | 3   | 52    | 8 <sup>th</sup> |
| <i>Capra hircus</i>           | Bile                          | 4  | 3  | 6  | 3  | 6  | 6  | 6  | 4  | 9  | 7   | 2   | 9   | 2   | 5   | 4   | 4   | 6   | 4   | 90    | 6 <sup>th</sup> |
| <i>Liotrigona spp.</i>        | Tinign honey                  | 3  | 1  | 8  | 5  | 1  | 8  | 7  | 8  | 3  | 1   | 4   | 7   | 5   | 6   | 8   | 5   | 5   | 8   | 93    | 5 <sup>th</sup> |
| <i>Bosindicus</i>             | Purified Butter $\geq 2$ year | 9  | 9  | 9  | 9  | 7  | 5  | 9  | 3  | 7  | 8   | 6   | 6   | 8   | 2   | 6   | 6   | 3   | 5   | 117   | 2 <sup>nd</sup> |
| <i>Trigona spp.</i>           | Tazma honey                   | 7  | 5  | 5  | 6  | 4  | 7  | 4  | 6  | 2  | 3   | 9   | 2   | 7   | 8   | 7   | 7   | 7   | 7   | 103   | 3 <sup>rd</sup> |
| <i>Numidameleagris</i>        | Meat                          | 2  | 8  | 1  | 4  | 2  | 1  | 1  | 1  | 1  | 4   | 1   | 4   | 1   | 4   | 1   | 1   | 2   | 1   | 40    | 9 <sup>th</sup> |

Table 7: Preferential ranking of 7 animal derived medicines to treat 'Dry Cough' based on 18 key informants

| Spp. Name                | Used part     | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | R13 | R14 | R15 | R16 | R17 | R18 | Total | Rank            |
|--------------------------|---------------|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----------------|
| <i>Gallus domesticus</i> | Egg           | 1  | 2  | 7  | 7  | 6  | 1  | 5  | 7  | 6  | 5   | 4   | 3   | 5   | 7   | 7   | 5   | 7   | 5   | 90    | 1 <sup>st</sup> |
| <i>Apismellifera</i>     | Larva & Honey | 7  | 6  | 3  | 5  | 1  | 5  | 7  | 5  | 4  | 6   | 3   | 6   | 6   | 6   | 4   | 7   | 2   | 4   | 87    | 2 <sup>nd</sup> |
| <i>Trigona spp.</i>      | Tazma honey   | 6  | 5  | 5  | 4  | 4  | 6  | 6  | 3  | 2  | 2   | 7   | 5   | 4   | 4   | 5   | 6   | 6   | 7   | 87    | 2 <sup>nd</sup> |
| <i>Liotrigona spp.</i>   | Tinign honey  | 5  | 1  | 6  | 2  | 3  | 7  | 2  | 4  | 7  | 7   | 6   | 4   | 7   | 2   | 6   | 4   | 3   | 6   | 82    | 4 <sup>th</sup> |
| <i>Capra hircus</i>      | Milk          | 3  | 3  | 2  | 1  | 7  | 4  | 1  | 2  | 3  | 4   | 2   | 2   | 3   | 5   | 2   | 3   | 5   | 1   | 53    | 6 <sup>th</sup> |
| <i>Bosindicus</i>        | Whey          | 2  | 7  | 1  | 6  | 2  | 2  | 4  | 6  | 1  | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 4   | 3   | 45    | 7 <sup>th</sup> |
| <i>Labeobarbus spp.</i>  | Meat          | 4  | 4  | 4  | 3  | 5  | 3  | 3  | 1  | 5  | 3   | 5   | 7   | 2   | 3   | 3   | 2   | 1   | 2   | 60    | 5 <sup>th</sup> |

## Figures

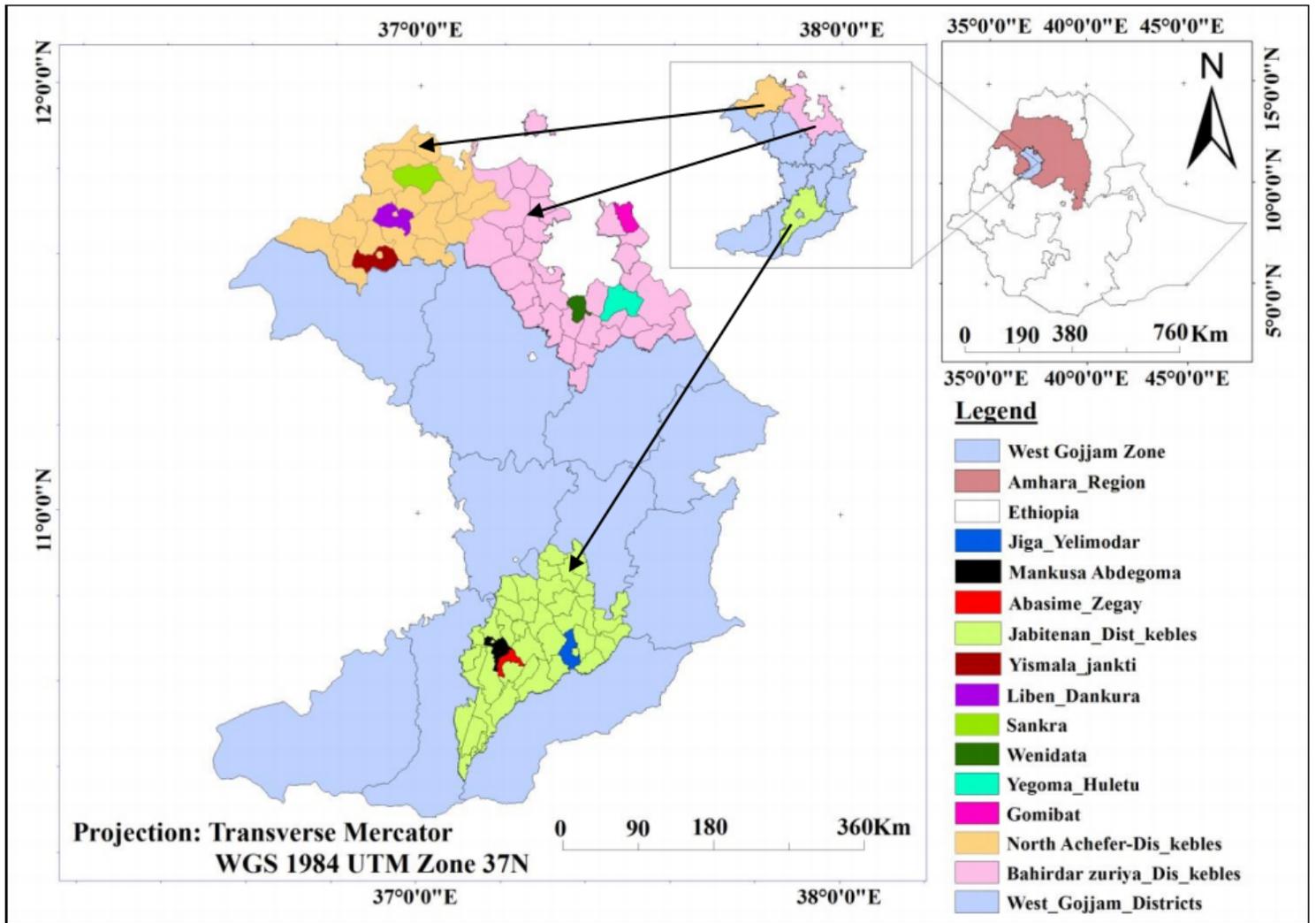
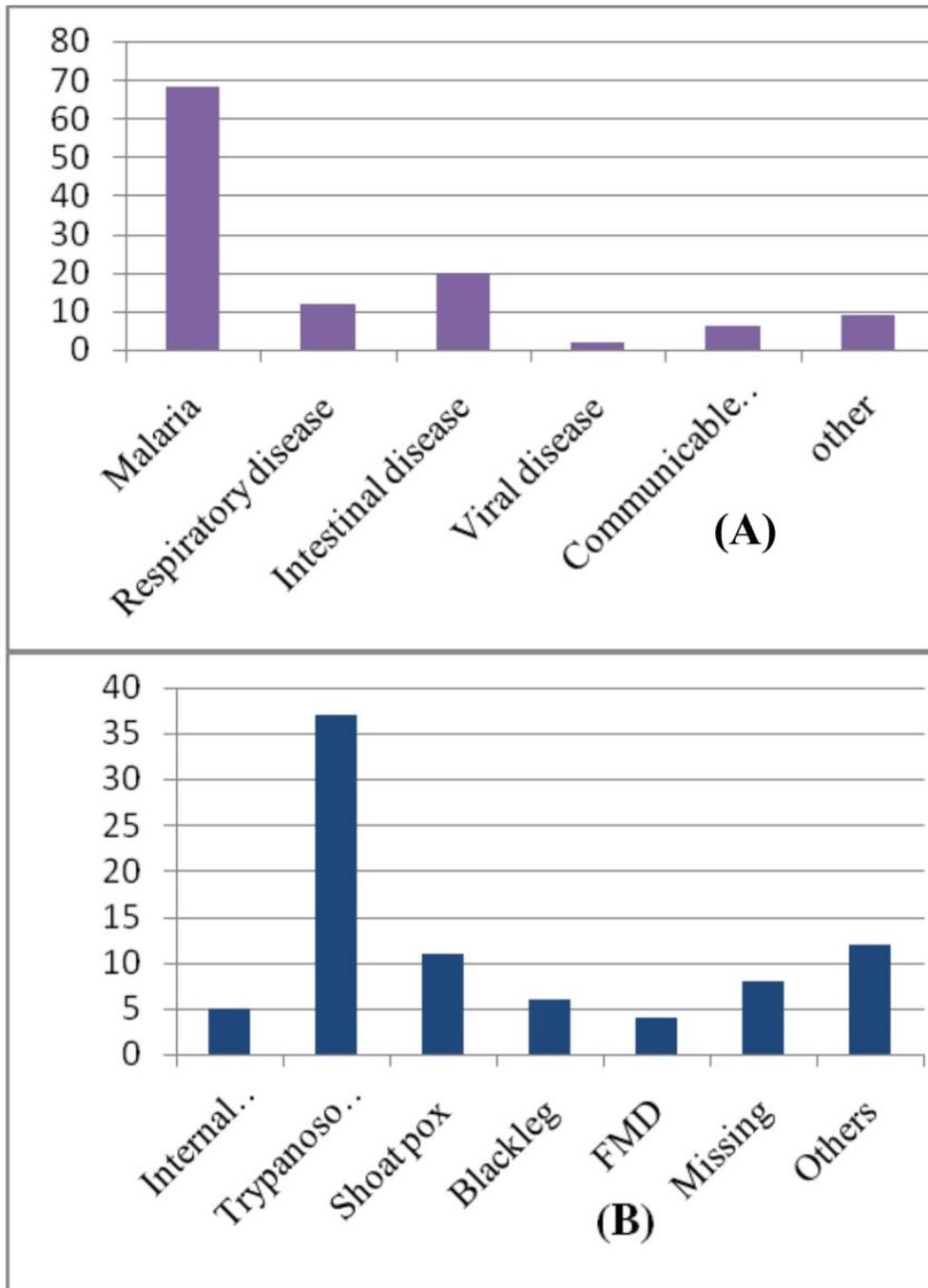


Figure 1

Map of the study area



**Figure 2**

The most common diseases of human (A) and animal (B) in the study area based on informants report.

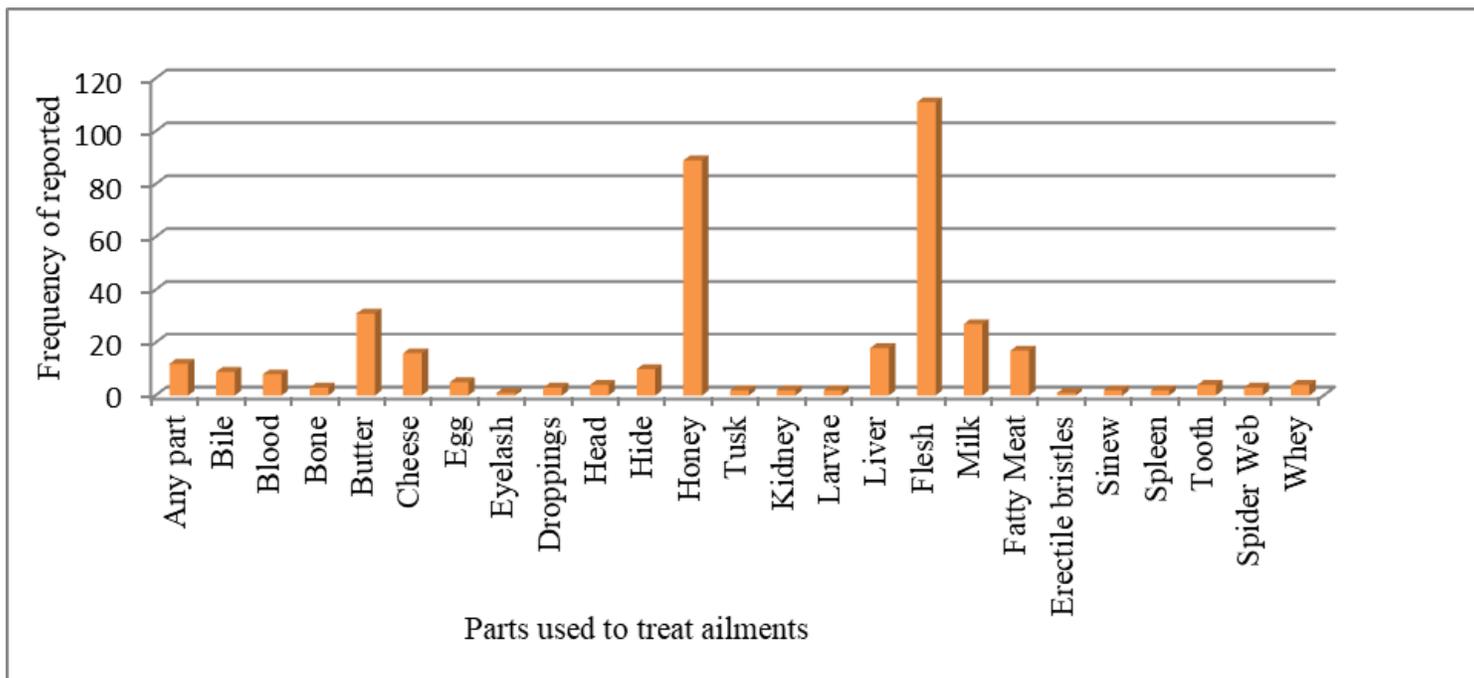


Figure 3

Animal parts and/or products used for the treatment of different ailments

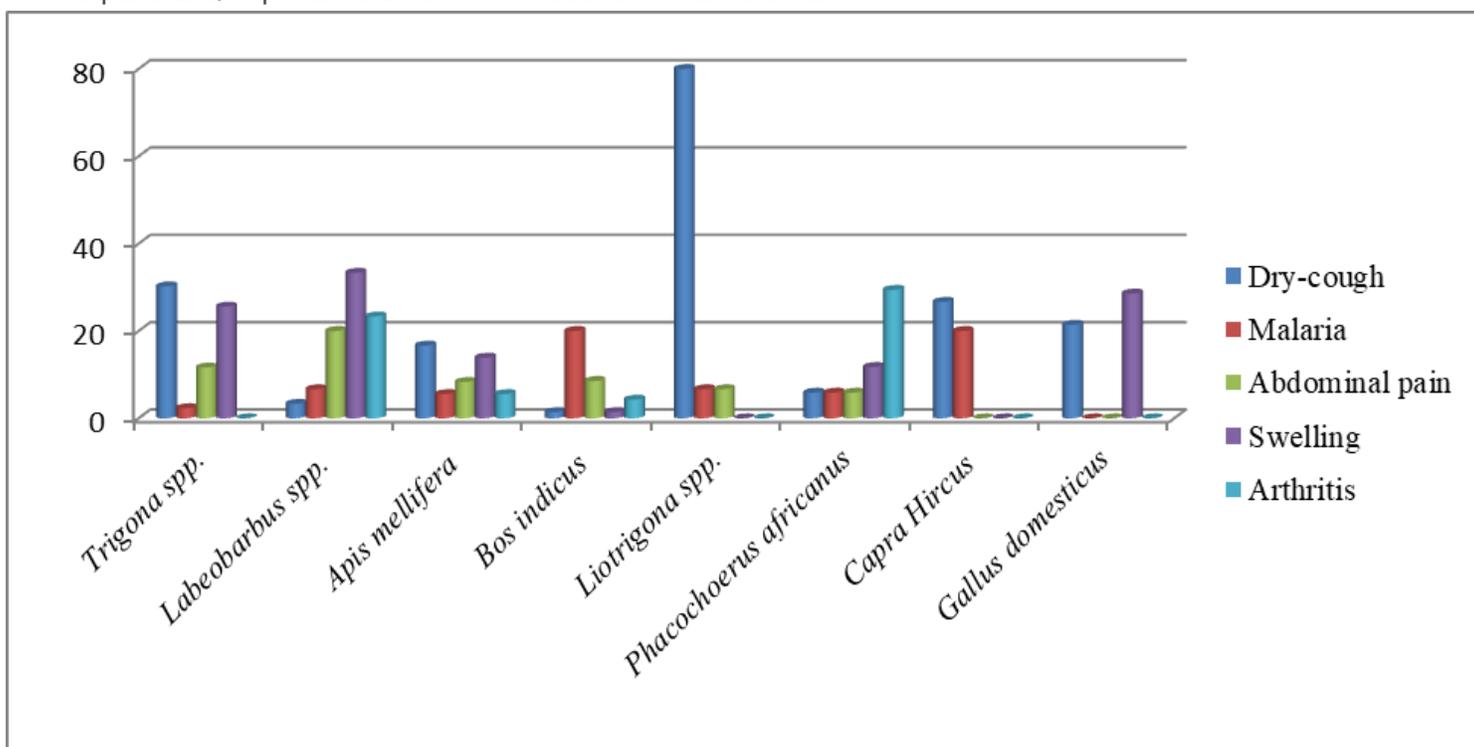


Figure 4

Fidelity level of animal derived medicines used for treating the selected ailments