

Survey of animals and their products used in traditional medicine in Jos and Bukuru metropolis, Plateau State, Nigeria

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ABSTRACT

Potent elixirs used for recreational and medical purposes are often prepared using by-products and parts of both wild and domesticated animals. In traditional medicine, they are used to manage both physical and spiritual illnesses. This study surveyed the various animals and animal products used in zootherapeutics in Bukuru and Jos metropolis, in Plateau State, Nigeria. Structured questionnaires were distributed to traditional healers, herb vendors and people willing to participate in the research. We carried out the survey between the months of January and March, 2022. The leaders of traditional healers' associations, butchers and abattoir workers were subjected to extensive oral interviews. The highest percentage (43.7%) of the respondents were within ages of 31- 45 years, while 60.6% were males. A total of 38 different animals were used for different zootherapeutic purposes against a plethora of diseases, which include sickle cell anaemia, diabetes, asthma, erectile dysfunction, infertility, cancer, stroke, jaundice, leprosy, toothache, epileptic seizures, bone fractures, rabies, rheumatism and other conditions. Prominent animal parts or by-products used in the survey include head, skin, gall bladder, urine, faeces, fats and oil. There is a generous wealth of knowledge in the application of animals and their products in zotherapy. The traditional claims of the treatment of diseases such as cancer, diabetes, sickle cell anaemia, cardiovascular disorders, bacterial and viral infections require empirical validation via biological and pharmacological examinations.

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INTRODUCTION

Nature has provided humanity with an enhanced environment for the development of traditional medicines since antiquity. The early man explored biodiversity in the ecosystem from plants, animals and minerals as sources of remedies for different ailments (Ahmad & Ahamad, 2020). The World Health Organization (WHO) reports that 80% of the world's population depends primarily on natural remedies for their health care needs (Oduntan, Akinyemi, Ojo, Ogunkayode, & Adesina, 2012). Animals and animal products constitute an important component of alternative medicine amongst many known practices (Chibueze & Seiyaboh, 2018).

Animal therapy is the use of medicines prepared from different animals or animal derived products to manage different human disease conditions (Timothy, Habib, & Ayodeji, 2018). In some parts of the world, animals and animal products are not just used to treat physical ailments, but they are also used in magic and other rituals (Timothy et al., 2018). The uncontrolled and diverse use of zootherapeutics has been reported as one of the reasons for the rise in wild life poaching in recent times (Adeola, 1992; Timothy et al., 2018). Animals, especially wild life and their by-products such as horns, hooves, skins, bones, feathers, tusks, fats and oils are employed in the preparation of popular elixirs for recreational or medicinal purposes globally (Adeola, 1992).

Traditional medical practitioners have formulated many remedies using plants, animals or animal by-products to manage diseases such as cancer, epilepsy, convulsion, diabetes and other disease conditions (Adeola, 1992). Although zotherapy is widespread in traditional medical practices, research on medicinal animals have often been neglected in comparison to medicinal plant research (Alves, Barbosa, Santos, Souto, & Barboza, 2011; Alves & Rosa, 2007; Oduntan et al., 2012; Timothy et al., 2018). Nowadays, zotherapy is receiving attention from various branches of science with some

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researchers focusing on the anthropological and cultural aspects, while others are studying the pharmacological effect of the substances involved (Alves et al., 2011; Oduntan et al., 2012; Timothy et al., 2018). This study surveys the various animals and animal products used in traditional medicine in Bukuru and Jos metropolis, in Plateau State, Nigeria.

MATERIALS AND METHODS

Location and Geographic Positioning System (GPS) of the study areas

The study was conducted in Adebayo and Massallacin Jumma's streets in Jos metropolis. Respondents around the Bukuru market and abattoir also participated in the study.

Adebayo Street is a popular site for the sales of medicinal herbs and traditional medicines. It is approximately 1.5 kilometers (km) away from the Jos terminus market and located on the following GPS coordinates: N 9° 55' 19 and E 8° 53' 19.83. Most of the herb sellers in Adebayo Street are from south-west Nigeria.

However, Massallacin Jumma's is located on the following GPS coordinates N 9° 55' 45.38 and E 8° 53' 19, and is about 4 km from the Jos terminus market. The herb vendors predominantly speak the Hausa language from northern Nigeria.

Similarly, Bukuru Market is located on the following GPS coordinates N 9° 47 and E 8° 51 and is approximately 16 km away from Jos, the capital city of Plateau State in north central Nigeria. Bukuru is the oldest and most densely populated settlement in Jos South Local Government Area in Plateau state. The market operates daily, with most herbalists and traditional healers based in the surrounding settlements, while others come from neighboring villages to market their commodities (Fig. 1).

Data Collection

One hundred (n=100) structured questionnaires were administered comprising of fifty (n =50) questionnaires each in Jos and Bukuru metropolis respectively. The questionnaires were read and translated to the non-English speaking

respondents especially in Adebayo street where most of the respondents speak only the Yoruba language, and in Massallacin Jumma's street where most of the respondents speak only the Hausa language. Extensive oral interview was conducted for leaders of the herb vendors and abattoir workers at the Bukuru market. The Hausa language was used in the interviews for proper comprehension and the avoidance of misinformation. A total of 71 questionnaires were completed. Animals whose use was mentioned by at least three persons were reported in this study. The study adopted the method by Oduntan et al., (2012) with modifications. The study was conducted between the months of January and March, 2022.

RESULTS AND DISCUSSION

In this study, the socio-demographic information indicated that the highest percentage (43.7%) of the respondents were within the age range 31-45 years, and 25.4% were within the age range of 46-60 years. The age ranges of 18-30 years, and from 60 years above were 21.1% and 9.9% respectively. The study revealed that most of the respondents were married, majority of whom were seeking for remedies to improve their sexual performances or cure infertility. The study revealed that women used zootherapeutics to enhance their children's intelligent quotients (IQ) and for nutritional purposes. Respondents within the age brackets of 45-60 years indicated that their knowledge and practice of traditional medicine was inherited from their parents, while the young generations seemed uninterested in the practice probably due to their inclination to orthodox medicines. Our findings were corroborated by Verma et al. (2014) in their survey of the use of zootherapeutics in Karbi Anlong tribe in Assam district in India. The study recorded a participation of 43 (60.6%) males and 28 (39.4%) female. The uneven distribution of male-female ratio reflected a report that says that men are more interested in the traditional medical practice than women. Timothy et al. (2018) also alluded to the fact that male children are likely to protect their cultural heritage than the females.

The study revealed that many people are more conversant with botanical medicines than zootherapeutics. Seventy-three percent (73%) of the respondents indicated that they have used plant products before, while 42% have used animal products for their health care needs. Other findings revealed that most respondents have knowledge of zootherapeutics but have never used it. This may be attributed to the availability of medicinal plants in comparison to animal products. Another factor is the cost; herbal remedies are cheaper than animal products (Chibueze & Seiyaboh, 2018). It is speculated that many people view animal medicines as fetish, mostly used as ingredients for charm preparation or mediums to appease deities. For instance, Adeola, (1992) Adeola, reported that animals such as python, buffalo, chimpanzee, owl, parrot are used in invoking witches and wizards, while tortoise, elephant warthog are used to appease the traditional gods. Additionally, in India, cows and snakes are considered sacred animals (Joshi & Joshi, 2010). In Brazil, various animals are used for magico-religious practices of Afro-Brazilian cult (Alves & Filho, 2007).

According to our findings, fats obtained from pythons; also called 'kitsen mesa' in the Hausa language were mostly used for the treatment of scars, rheumatism, back pain, burns and waist pain (Table 1). Similarly, Mukherjee et al. (2017)

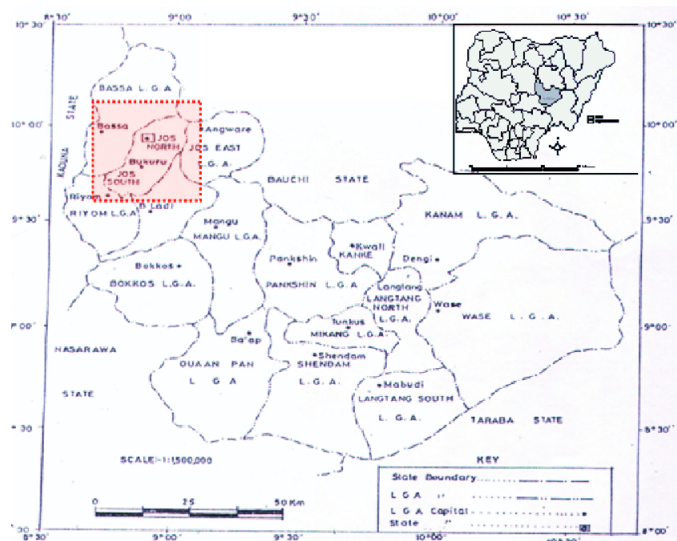


Fig. 1: Map of Plateau State showing the survey areas in red colour. Source: Ndace & Danladi, (2012)

Table 1: Animals, part(s) and products used in traditional medicine in Jos and Bukuru Metropolis Jos, Plateau state, Nigeria

S/No.	Scientific/common names	Local name(s)	Part(s)/Product used	Traditional uses
1	Family Pythonidae (Pythons)/ Snake	Mesa (H)	Oil	Skin injury, scars, rheumatism, back pain, burns and waist pain
			Fat	Joint dislocation/bone fracture, ankle pain
			Head	Used as antivenom in cases of snake bite
			Skin	Seizures and general epileptic disorders
2	<i>Elephas africanus</i> (Loxodonta)/ Elephant	Giwa (H)	Faeces	Fear and nightmare
3	<i>Hippopotamus amphibius</i> / Hippopotamus	Dorinar ruwa (H)	Fat	Cold
4	<i>Struthio camelus</i> / Ostrich	Jimina (H)	Legs	Used by athletes and hunter, believed to enhance speed
			Eyes	Aesthetics
			Eggs	Protein deficiencies such as kwashiorkor
5	<i>Felis silvestris libyca</i> / African wild cat	Dageji (F) or Dage (H)	Head	Protection against knife cut or cut by any sharp object
6	<i>Syncercus caffer</i> / African buffalo	Baffa (H)	Tail	To wade off evil spirits and magical rituals
			Bones	Wound healing
7	<i>Plecoglossus altivelis</i> / Ayu	Ayu (H)	Oil	Aphrodisiac, increase female breast size, male infertility, prostate cancer, lactogenic
8	<i>Chamaeleo calyptratus</i> / Chameleon	Hawainiya (H)	Whole animal	Attracts good fortune, disguise one's identity or makes one invisible
9	<i>Centrochelys sulcata</i> / Tortoise	Kunkuru (H)	Whole	Haematinics, sickle cell anaemia
10	<i>Gallus domesticus</i> / Chicken	Kaza (H)	Feathers	Sickle cell anaemia
11	<i>Papio ursinus</i> / Baboons	Babban, Bika, Gwaggo (H)	Head	Wade off evil spirits
12	<i>Bos taurus</i> / Cattle	Shanu (H)	Gall bladder/bile	Malaria, ulcer, eye disease
			Faeces	Kwashiorkor
			Urine	Wound healing
			Milk from cow	Improves intelligence quotient (IQ) of a child, reduces fat, ulcers
			Fat	Body pain
13	<i>Camelus dromedarius</i> / Camel	Rakumi (H)	Skin	Bedwetting
			Liver	High blood pressure
			Milk	Kidney stones
			Hump	Love charm
			Urine	Sickle cell anaemia
14	<i>Bos taurus</i> / Bull	Sa, Bijimi (H)	Faeces	whitlow
			Bone marrow	Rheumatism
15	<i>Capra aegagrus hircus</i> / Goat	Akuya (H)	Milk	Ulcer
			Gall bladder	Ulcer
16	<i>Canis familiaris</i> / Dog	Kare (H)	Hair	Rabies
			Meat	Boost immunity against malaria and other diseases, aphrodisiac, diabetes
			Liver/heart/penis/testicles	Love charm, erectile dysfunction and early ejaculation
17	<i>Panthera leo</i> / Lion	Zaki (H)	Skin	Wade off evil spirits
			Fat	Magical power, skin cosmetics (maintains youth and vitality)
18	<i>Apis mellifera</i> / Bee	Kudan zuma (H)	Honey	Immunity booster, stomach ache, acne, improves mental capacity, sore throat, heat burn, ulcers
19	<i>Sus scrofa domesticus</i> / Pigs	Alade (H)	Fat	Ulcers, poisoning
20	Chicken eggs	Kwai (H)	Rotten	Charm to separate lovers
			Yolk	Charm for protection

S/No.	Scientific/common names	Local name(s)	Part(s)/Product used	Traditional uses
21	<i>Electrophorus electricus</i> / electric eel/ eel	Irin, Bano, Gwando (H)	Whole fish	Stroke, heart disorders, charm that protects against capital punishment
22	<i>Centruroides vittatus</i> / Scorpion	Kunama (H)	Whole Venom Eggs	Improves courage and aggression, Scorpion sting Ear problem
23	<i>Equus caballus</i> / Horse	Doki (H)	Fat Urine	Tooth decay and tooth ache Sickle cell anaemia
24	<i>Agama agama</i> / Lizard	Kadangare mai jan kai (H)	Tail	Whooping cough, tuberculosis, cough
25	<i>Caurassius auratus</i> / Goldfish	Kifin zinari (H)	Whole	Aphrodisiac, immunity booster
26	<i>Rattus fuscipes</i> / Bush rat	Beran daji (H)	Whole	Leprosy
27	Maggots/ worms or larvae	Tsutsotsi, Tsiro (H)	Whole	Jaundice
28	<i>Sylvilagus bachmani</i> / Bush rabbit	Zomon daji (H)	Whole	Hypertension, memory retention
29	<i>Spilopelia senegalensis</i> or <i>Columba senegalensis</i> / Dove	Kurciya (H)	Whole	Hiccups
30	<i>Ovis aries</i> / sheep	Tunkiya, Tumaki (H)	Offal	Breast pain
31	<i>Macaca radiata</i> / Monkey	Biri (H)	Head	Convulsion
32	<i>Aleiodes indiscretus</i> / Wasp	Zanzaro (H)	Fluid Nest	Wound healing Mumps
33	<i>Crocodilus niloticus</i> / Crocodile	Kada (H)	Whole	Protective charms
34	<i>Formica rufa</i> / Ants	Tururuwa (H)	Whole	Promiscuity
35	Family Erinaceidae/ Hedgehog	Bushiya (H)	Whole	Breast cancer, promiscuity
36	<i>Helix pomatia</i> / snail	Katantanwa, kodi (H)	Meat Shell	Leprosy Evil spirits
37	<i>Odocoileus virginianus</i> / Deer	Barewa (H)	Legs	Strengthen the limbs of toddlers to start walking early and fast
38	<i>Rana temporaria</i> / Frog	Kwado (H)	Whole	Cough

H = Hausa language

corroborated our findings and added that python's fats could also serve as remedies for vision problems. The head of the snake is used as an antivenom in cases of snake bite. Snake skins, when pulverized and mixed with olive oil could serve as skin repair creams. The Bastar tribe of Chhattisgarh in India uses the King-cobra's blood to increase sexual prowess and virility (Joshi & Joshi, 2010). In northeastern Brazil, the head and eye of rattle snake is used to treat kidney diseases, asthma, cancer and repel evil spirits (Alves & Filho, 2007).

On the contrary, most of the animals used for zootherapeutics are also used for food. Dog meat for instance, is eaten by some people for pleasure while others eat it for medicinal reasons. Dog meat is reported to be used to treat diabetes, while some people believe that eating it boosts the immune system. Other people eat the genitals as sexual performance enhancers (Elisha & Solomon, 2008). Dog urine has also been reported to be used to cure ear-ache when applied topically (Mahawar & Jaroli, 2006). The hair from the dog that has bitten a person is applied to the site of bite as prophylaxis to rabies among some tribes in Plateau State of Nigeria.[12] The heart and liver of dogs are used to prepare 'love portions'. This is due to the general belief that dogs are loving, caring and loyal to their masters, such traits are believed to affect the persons' jinxed (Belinda, Akanle, Yikwabs, & Nomishan, 2020).

Our study indicated that honey is one of the most commonly used animal products, 39.4% of the respondents confirmed that

they have used honey to treat stomach upset, acne, burns, scars, ulcers, and sore throats (Table 1). It has been reported that the Saharia tribe of the Rajasthan use honey to treat eye infections (Mahawar & Jaroli, 2007). In Brazil, honey is used to treat asthma, tuberculosis and prostrate problems (Alves & Rosa, 2007). To treat cancer, the rural people around Gibbon wild life sanctuary in Assam, grind the whole honey bee, mix it with water and administer orally (Borah & Prasad, 2017). Research also shows that honey has potent antibacterial and antifungal properties (Molan, 1992).

Fresh milk from animals such as cows, goats, sheep and camels aside been taken as food has remarkable medicinal uses. Cow milk is fed to new born babies as it is believed to make a child intelligent. Cow or sheep's milk, when mixed with gallbladder is used to treat stomach ulcers. In India, goat milk is used to treat mouth ulcers (Mahawar & Jaroli, 2006). Camel milk when boiled and mixed with the pulverized leaves of *Parkia biglobosa* and *Pterocarpus erinaceus* has been endorsed as a cure for kidney stones by some of our respondents. In Iranian traditional medicine, camel milk is reported to treat liver pain, renal weakness, gastrointestinal cancer and menstrual cramp (Hosseini, Zibae, Yousefi, Taghipour, & Noras, 2015). Indians use camel milk as a massage cream to relieve muscle pain (Mahawar & Jaroli, 2007).

Our study further revealed that animals' urine and dung are useful in traditional medicine. For example, cow dung is

used to treat kwashiorkor, Elephant dung, when dried and burned serves as incense against nightmares. Mahawar & Jaroli, (2006) asserted that the mixture of cow dung and milk when applied externally relieves muscle pain. Cow urine is reported to have wound healing properties, while the Camel urine is used to treat sickle cell disease. According to Kakati et al. (2006) the Ao tribe of Nagaland use goat urine to treat asthma, tuberculosis, skin diseases and stomach disorders. In addition, some animals' parts are used as medicines due to their anatomical and physiological attributes. For example, the ostrich's leg is used to make medicines for soccer players, athletes and hunters to enhance their speed. In Bangladesh, the traditional medical practitioner prescribes the eating of domesticated bull testicles to increase libido in men (Zubaida, Bhuiyan, Roney, & Rahmatullah, 2013).

In this study, some respondents were reluctant to disclose information related to their trade, while a few did not provide information at all. A trusted source has confided to us that, disclosing some information on zootherapy will reduce the efficacy of the therapeutics. Thus, information is only shared when one is in a dire need to do so. And in the family, where they have someone gifted with the knowledge of traditional medicines, the person does not disclose the information to a total stranger. Knowledge of these sort is only passed to someone with a certain potential. Giving such information in exchange for money has also been reported to decrease the efficacy of the remedy. This belief is also common to the Bastar tribe of Chhattisgarh in India (Joshi & Joshi, 2010).

CONCLUSION

The use of various animals' parts in traditional medicine to treat both physical and spiritual ailments such as diabetes, asthma, cancer, stroke, rabies, rheumatism, arthritis etcetera, has been observed in our survey. This is a clear indication that there is a wealth of knowledge in traditional medical practice that requires biological and pharmacological exploration and validation. However, the constant use of animals' parts of rare species like the lions, elephants and Ayu is detrimental to the animals and the research world. Therefore, there is the need for research alternatives to avoid endangering these animals.

Consent approval: The respondents consented willingly to participate in the survey.

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Authors contributions: Conceptualization and design of the research was carried out by ZM and ILE. The questionnaire was prepared by ILE and ZM. Data collection and extensive interviews was conducted by ZM and OKF. Data was analyzed by GJG and ZM. The first draft manuscript was written by ZM and ILE. Critical reading, and review of the final manuscript was carried out by OKF, MMS, SBZ, JGU, HJ, AEI, AEJ, TBK, GJG, BY and MM. Final approval and contributions for the publication of the manuscript was made by all authors.

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REFERENCES

1. Adeola, O. M. (1992). Importance of wild animals and their parts in the culture, religious festivals and traditional medicine of Nigeria. *Environmental Conservation*, 19(2), 125-134. <https://doi.org/10.1017/S0376892900030605>
2. Ahmad, J., & Ahamad, J. (2020). Bioactive phytochemicals: Drug discovery to product development in drug discovery from plant sources: scope, approach and challenges. In J. Ahmad & J. Ahamad (Eds.), *Bioactive phytochemicals - drug discovery to product development* (pp. 1-12). Singapore: Bentham Science Publishers.
3. Alves, R. R. N., Barbosa, J. A. A., Santos, S. L. D. X., Souto, W. M. S., & Barboza, R. R. D. (2011). Animal-based remedies as complementary medicines in the semi-arid region of northeastern Brazil. *Evidenced-Based Complementary and Alternative Medicine*, 1-15. <https://doi.org/10.1093/ecam/nep134>
4. Alves, R. R. N., & Filho, G. A. P. (2007). Commercialization and use of snakes in North and Northeastern Brazil: implications for conservation and management. *Biodiversity and Conservation*, 16, 969-985. <https://doi.org/10.1007/s10531-006-9036-7>
5. Alves, R. R. N., & Rosa, I. L. (2007). Zootherapy goes to town: the use of animal-based remedies in urban areas of NE and N Brazil. *Journal of Ethnopharmacology*, 113(3), 541-555. Retrieved from [http://digilib.unila.ac.id/11478/16/16_BAB II.pdf](http://digilib.unila.ac.id/11478/16/16_BAB%20II.pdf)
6. Belinda, D. G., Akanle, O., Yikwabs, Y. P., & Nomishan, T. S. (2020). Zootherapy: The use of dog meat for traditional African medicines in Kanke Local Government Area, Plateau, Nigeria. *Journal of Tourism and Heritage Studies*, 9(2), 1-14. <https://doi.org/10.33281/jths20129.2020.2.1>
7. Borah, M. P., & Prasad, S. B. (2017). Ethnozoological study of animals based medicine used by traditional healers and indigenous inhabitants in the adjoining areas of Gibbon Wildlife Sanctuary Assam. *Journal of Ethnobiology and Ethnomedicine*, 13, 39. <https://doi.org/10.1186/s13002-017-0167-6>
8. Chibueze, I. S., & Seiyaboh, E. I. (2018). Challenges of wildlife with therapeutic properties in Nigeria; a conservation perspective. *International Journal of Avian and Wildlife Biology*, 3(4), 252-257. <https://doi.org/10.15406/ijawb.2018.03.00096>
9. Elisha, I. L., & Solomon, P. (2008). Cruelty to dogs: A survey of response in Bukuru metropolis, Jos- Nigeria. *Nigerian Veterinary Journal*, 29(1), 63-67.
10. Hosseini, S. M. R., Zibae, S., Yousefi, M., Taghipour, A., & Noras, M. (2015). Camel's Milk: Nutrition and Health Perspectives Iranian Traditional Medicine. *International Journal of Pediatrics*, 3(1-5), 915-920.
11. Joshi, T., & Joshi, M. (2010). Ethno-ophiology - A traditional knowledge among tribes and non- tribes of Bastar, Chhattisgarh. *Indian Journal of Traditional Knowledge*, 9(1), 137-139.
12. Kakati, L. N., Bendang, A., & Doulo, V. (2006). Indigenous knowledge of zootherapeutic use of vertebrate origin by the Ao tribe of Nagaland. *Journal of Human Ecology*, 19(3), 163-167. <https://doi.org/10.1080/09709274.2006.11905874>
13. Mahawar, M. M., & Jaroli, D. P. (2006). Animals and their products utilized as medicines by the inhabitants surrounding the Ranthambhore national park, India. *Journal of Ethnobiology and Ethnomedicine*, 2(46), 1-5. <https://doi.org/10.1186/1746-4269-2-46>
14. Mahawar, M. M., & Jaroli, D. P. (2007). Traditional knowledge on zootherapeutic uses by the Saharia tribe of Rajasthan, India. *Journal of Ethnobiology and Ethnomedicine*, 3, 25.

15. Molan, P. C. (1992). The antibacterial activity of honey. *Bee World*, 73(1), 5-28. <https://doi.org/10.1080/0005772x.1992.11099109>
16. Mukherjee, S., Gomes, A., & Dasgupta, C. S. (2017). Zootherapeutic uses of snake body parts in folk and traditional medicine. *Journal of Zoological Research*, 1(1), 1-9.
17. Ndace, J. S., & Danladi, M. H. (2012). Impact of derived tin mining activities on land use/land cover in Bukuru Plateau State, Nigeria. *Journal of Sustainable Development*, 5(5), 90-100. <https://doi.org/10.5539/jsd.v5n5p90>
18. Oduntan, O. O., Akinyemi, A., Ojo, O., Ogunkayode, O., & Adesina, O. (2012). Survey of wild animals used in zootherapy at Ibadan, Oyo State, Nigeria. *International Journal of Molecular Zoology*, 2.
19. Timothy, S. K., Habib, D. U., & Ayodeji, A. E. (2018). Survey of zoological materials used in traditional medicine in Sabon Gari and Zaria Local Government Areas, Kaduna State, Nigeria. *Journal of Complementary Medicine Research*, 8(1), 32-39.
20. Verma, A. K., Prasad, S. B., Rongpi, T., & Arjun, J. (2014). Traditional healing with animals (zootherapy) by the major ethnic group of Karbi Anglong District of Assam, India. *Journal of Pharmacy and Pharmaceutical Sciences*, 6(8), 593-600.
21. Zubaida, K., Bhuiyan, P., Roney, M. S., & Rahmatullah, M. (2013). Traditional knowledge on zootherapeutic practices among some folk medicinal practitioners of Bangladesh. *America-Eurasian Journal of Sustainable Agriculture*, 7(3), 155-161.