Traditional Medicinal plants used in Ethiopia for Animal diseases treatment

Abebe Mequanent [1], Getinet Ayalew [2], Habtamu Addis [1]

[1] University of Gondar College of Veterinary Medicine and Animal Science, Department of Veterinary Clinical Medicine, Gondar, Ethiopia, P.o. Box: 196
[2]University of Gondar, college of computational and natural science, department of biotechnology
E-mail: abebemequanent@gmil.com

Summary: Traditional medicines have been used for nearly 90% of livestock populations in Ethiopia where complimentary remedies are required to the modern health care system. All plants with pharmacological activity complimentarily prescribed as best choice against livestock diseases. Availability of veterinary services is a major constraint in the arid areas of Ethiopia. The government resources to run veterinary practices do not meet the rising costs of within the veterinary sector. An increasing number of pastoralists are turning to Ethnoveterinary medicine. Ethnoveterinary practices concern to animal healthcare is as old as the domestication of various livestock species. They comprise belief, knowledge, practices and skills pertaining to healthcare and management of livestock. Substances or medicinal plants used for Ethnoveterinary treatments include, Whistling thorn (Grar), White albizia (Bisna), Garlic (nech shinkurt), Aloe (Iret), Desert date (Goza), Hot pepper (Berbere), Papaya (Papaya), Carissa (Agam), Velvet-leaved combretum (Avalo), Broad-leaved croton (Bisana), Devils's trumpet (At'efaris), Lemon-scented gum (Shito-barzaf), Tree euphorbia (K'ulk'wal), Lantana (Yemichi-medihanit/ Kese), Microglossa (Nech'i-weyinagift), Tobacco plant (Timbaho), Sodom apple (Imbway), Ginger (Jinjibil) and Tree vernonia (Grawa) were used.

[Abebe M, Getinet A, Habtamu A. **Traditional Medicinal plants used in Ethiopia for Animal diseases treatment.** *Biomedicine and Nursing* 2017;3(2): 31-41]. ISSN 2379-8211 (print); ISSN 2379-8203 (online). http://www.nbmedicine.org. 5. doi:10.7537/marsbnj030217.05.

Key words: Medicine, Ethnoveterinary medicine, medicinal plants.

1. Introduction

In sub-Saharan Africa, tens of millions of pastoralists, agro-pastoralists and other farmers rely on livestock as important sources of food and income. Many pastoralists and agro-pastoralists live in marginal arid and semi-arid zones where livestock production contributes importantly to the resilience of communities, while most of the meat consumed in East Africa, and more than half of the milk, is estimated to come from pastoral herds. In Kenya, the livestock sector has been estimated to contribute 50% of agricultural production by value, in Tanzania approximately 30%, and in Ethiopia and Uganda around 19% (Balakrishnan, 2009).

Animal health is a major constrain to livestock production in East African countries, with a number of diseases causing major production losses and threats to human health. The impacts of animal diseases are particularly severe for poor communities that although relying heavily on livestock have limited access to modern veterinary services. Pastoralists, agro-pastoralists and other, small-scale, farmers in the East Africa region have engaged in a long tradition of Ethnoveterinary practices to care for their animals, involving the use of many plants to prevent and treat different diseases and health conditions. These practices are still widely applied, often because of the lack of availability or the prohibitive costs of 'modern' veterinary medicines and approaches. Sometimes, 'modern' veterinary practices for particular contagious diseases and Ethnoveterinary medicine for other conditions are employed in tandem by livestock holders, and this situation is likely to continue in the coming decades (Kohler, 2001). Hundreds of plant species have been identified by traditional practitioners for treating a wide range of livestock (and human) ailments, although the efficacy of plant treatments has often not been tested through formal trials, on which more work is required. Nevertheless, a large body of information on traditional use, over a number of centuries in many cases for indigenous plants, supports their utility for treatment and control (Martin *et al*., 2001).

2. Ethnoveterinary Medicine

2.1. History of Ethnoveterinary Medicine

Veterinary medicine as practiced today has roots its roots in herbal medicine, as practiced in prehistory in China, India and the Middle East. The literature indicates that Arabia was the world centre of veterinary and other medical knowledge in the early middle Ages. With the spread of Islam some of this knowledge made its way into Africa and was adopted by stock raisers (Masikati, 2010). Ethnoveterinary medicine was practiced as early as 1800 B.C. at the time of King Hamurabi of Babylon who formulated

laws on veterinary fees and charged for treating cattle and donkeys. Traditional veterinary practices have been around for a long time and were the only medicine available until nineteenth century. In fact, all veterinary practices before the coming of the orthodox veterinary medicine can be called "traditional" veterinary knowledge (Masimba *et al*., 2011). Many traditional medicines have been abandoned following the discovery of the modern chemotherapy. But for more than a decade now Ethnoveterinary medicine (EVM) has experienced a revival and several reports have been published. This growing interest in traditional practices had been encouraged by the recognition of some efficacious Ethnoveterinary medicine (EVM) products (Mathias, 1994, 1995).

2.2. Definition

Ethnoveterinary medicine is the scientific term for traditional animal health care, encompasses the knowledge, skills, methods, practices, and beliefs about animal health care found among the members of a community. The knowledge base differs not only from region to region but also among and within communities. It has been developed through trial and error and deliberate experimentation (Wazala *et al*., 2005). Ethnoveterinary medicine is defined as a holistic comprehension of the indigenous systems of animal health, their interpretation through western medicine and the development of effective and appropriate technologies. Define Ethnoveterinary medicine (EVM) as dealing with the folk beliefs, knowledge, skills, methods and practices pertaining to the health care of animals (Tyasi *et al*., 2015). Gives description of Ethnoveterinary medicinal research as the holistic interdisciplinary study of the local knowledge and the socio-cultural structures and environment associated with animal health care and husbandry (Mlambo *et al*., 2011).

2.3. Validating Ethnoveterinary Medicine

Ethnoveterinary practices need to be validated before they can be widely promoted (Najima *et al*., 2015). Several levels of validation are possible:1) Tapping the experience of local people, for example, by asking them to rank local treatments according to their perceived efficacy, 2) Searching the literature for available information on the botany, phytochemistry, and *in-vitro, in-silico* (i.e., computer-based) and *in-vivo* tests, and other relevant aspects. 3) Conducting laboratory tests.4) Conducting clinical tests on station or in experimental herds. 5) Conducting clinical tests in selected herds kept by smallholders and pastoralists. 6) Alternatively, farmers may conduct their own tests. 7) Monitoring the use of remedies in the field. 8) Studying a remedy's influence on production and economic parameters (Thobela *et al*., 2015).

3. Economics Significance

Up to now, the literature offers little data on the economic impact of promoting Ethnoveterinary medicine. There are some indications that the use of Ethnoveterinary medicine can have economic advantages (Marandure, 2016): 1) Plant preparations that livestock keepers can prepare themselves from crude materials will cost them less than buying the same mixture ready to use, but the latter may be much cheaper than equivalent allopathic alternatives. In Sri Lanka a locally processed herbal wound-powder was found to be as effective, but cost 80-90% less (Nalule *et al.,* 2011). 2) Commercial herbal products may not be in all cases the cheaper alternative. *Karanji* oil, an Indian treatment for mange that could be used instead of Butox, is difficult to get in some parts of Rajasthan, and when it is available, is more expensive than Butox (Marandure, 2016). 3) If commercial herbal drugs are exported to other countries, they may there become nearly as expensive as other imported allopathic drugs. 4) Scientific research and farmer experiments in Trinidad and Tobago found that adding preparations from plants such as aloe and *Momordica charantia* to the drinking water can improve the productivity and profitability of flocks of broilers. Other sources also state that effective local plant medicines can reduce both household and project expenditures on commercial drugs (Najma *et al*., 2015).

According to the review it has to be concluding as: Ethnoveterinary medicine can make an economic difference, but its cost-effectiveness varies, and depends on many different factors. In-depth studies are needed to determine how the economic potential of Ethnoveterinary medicine can be best utilized. The example from Ethiopia and Kenya highlights that the usefulness is not restricted to smallholders and resource-poor farmers, but also applies to intensive production units (Thobela *et al*., 2015).

4. Advantages And Limitations Of Ethnoveterinary Medicine

4.1. Advantage of Ethnoveterinary medicine (EVM)

Ethnoveterinary medicine has the following advantages in veterinary medicine; 1) easy to administer (Mostly given orally or topically). 2) Most Ethnoveterinary medicine (EVM) products are effective to some extent especially those with anthelmintic properties, for example *Eucalyptus grandis* was found to be effective against *Haemonchus controtus*. 3) It is cheap and readily available. 4) Livestock owners are already familiar with Ethnoveterinary medicine (EVM) (Thobela *et al*., 2015).

4.2. Limitations or disadvantage:

Some of the disadvantages of Ethnoveterinary medicine are; 1) Lack of Scientific validation of most Ethnoveterinary therapies.2) Time consuming and inconveniences involved in their preparations and use. 3) Only seasonal availability of certain medicinal plants. 4) Lack of integration with orthodox practices. 5) Ethnoveterinary medicines are often not as fast-working and potent as allopathic medicines. They may therefore be less suitable to control and treat epidemic and endemic infectious diseases (e.g., foot-and-mouth disease, rinder pest, hemorrhagic septicemia, anthrax, black quarter, rabies), and acute life-threatening bacterial infections (e.g., generalized cases of coli- or pyogenes mastitis). For these problems, modern drugs might be the best choice. 6) Paucity of treatment against the infectious epidemic diseases such as Rinder pest and Foot and Mouth Diseases. 7) Existence of inappropriate practices like cauterizing the vulva of the cows, to induce heat or treat urinary blockages, and for the treatment of the infectious diseases. 8) Difficulty in standardizing herbal therapies as the concentration of active ingredient varies in different parts of the plants. 9) Some treatments are ineffective. 10) Some practices are harmful. 11) Traditional diagnoses may be inadequate (typically identifying symptoms rather than underlying causes of a disease). 12) Dosages are uncertain and remedies are not standard. 13) The resource base is deteriorating, making ingredients unavailable for preparing medicines (Stevenson *et al*., 2010).

5. Medicinal Plants Used For Ethnoveterinary Medicine In Ethiopia

Medicinal plants used for Ethnoveterinary medicine in Ethiopia being discussed with their common name, scientific name, photograph and traditional therapeutic use accordingly;

1. Common name: Whistling thorn (Grar) is used for **Conditions treated/controlled:** Metritis (infected uterus and vaginal discharge); Retained placenta (retained afterbirth); Sheath rot (discharge from the penis); Venereal diseases (Najma *et al*., 2015).

Figer: 1 Acacia drepanolobium and Acacia drepanolobium flowers (source: Najma *et al*., 2015)

2. **Common name:** White albizia (Bisena): **Conditions treated/controlled:** Liver fluke disease (fasciolosis); Lungworms (ascaris worms) (Najma *et al*., 2015).

Figure 2. Albizia anthelmintica bark and *Albizia anthelmintica* tree (Najma *et al*., 2015)

3. **Common name:** Garlic (Nech'i-shinkurt) used for **Conditions treated/controlled:** Colds, coughs and pneumonia; Lice; Stomach and intestinal worms; Ringworm (Najma *et al*., 2015).

Figure: 3 Allium sativum fresh plants and bulbs (Najma *et al*., 2015)

4. **Common name:** Aloe (Iret) used for **Conditions treated/controlled:** Avian coryza (infectious coryza); Castration; Coccidiosis (coccidia) and colibacillosis; Colds, coughs and pneumonia; Diarrhoea; Eye diseases and problems, general treatment; Fleas; Fowl cholera (pasteurellosis); Lumpy skin disease; Metritis (infected uterus and vaginal discharge); Mites; Newcastle disease (fowl pest); Pox; Salmonellosis (fowl typhoid, pullorum disease); Sheath rot (discharge from the penis); Ticks; Venereal diseases; Wounds (Najma *et al*., 2015).

Figure:4 Aloe secundiflora plants (source: Najma *et al*., 2015)

5. **Common name:** Desert date (Goza) used for **Conditions treated/controlled:** Anthrax; Eye diseases and problems, general treatment; Retained placenta (retained after birth) (Najma *et al*., 2015).

6. **Common name:** Hot pepper (Green and Red) (Berbere) used for **Conditions treated/controlled:** Anaplasmosis; Avian coryza (infectious coryza); Colds, coughs and pneumonia; Contagious pleuropneumonia (bovine and caprine); Diarrhoea; Fowl cholera (pasteurellosis); Heart water (cowdriosis); Newcastle disease (fowl pest); Stomach and intestinal worms (Najma *et al*., 2015).

Figure: 5 Balanites aegyptiaca tree and *Balanites aegyptiaca* flowers (source: Najma *et al*., 2015)

Figure:6 Capsicum frutescens fruit (Red pepper) and (Green pepper) (source: Najma *et al*., 2015)

7. **Common name:** Papaya (Papaya) used for **Conditions treated/controlled:** Constipation; Retained placenta (retained afterbirth) (Najma *et al*., 2015)

Figure: 7 Carica papaya unripe fruit and *Carica papaya* leaves (source: Najma *et al*., 2015)

8. **Common name:** Carissa (Agam) used to **Conditions treated/controlled:** Ringworm; Stomach and intestinal worms (Najma *et al*., 2015).

Figure: 8 Carissa spinarum branch with leaves and *Carissa spinarum* fruit (source: Najma *et al*., 2015)

9. **Common name:** Velvet-leaved combretum (Agalo/ Avalu) used to **Conditions treated/controlled:** Pink-eye (kerato-conjunctivitis) (Najma *et al*., 2015).

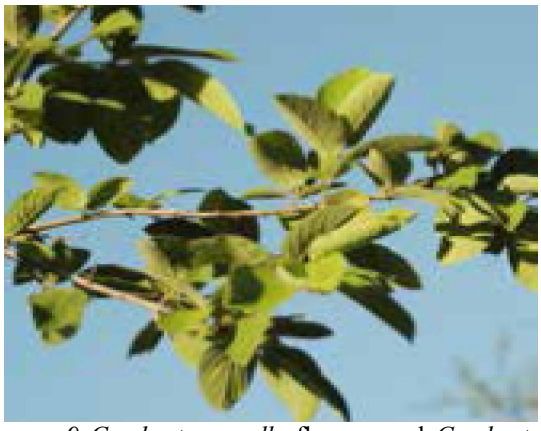

Figure: 9 Combretum molle flowers and *Combretum molle* leafy branch (source: Najma *et al*., 2015)

10. **Common name:** Broad-leaved croton (Bisana) used to **Conditions treated/controlled:** Wounds.

Figure: 10 Croton macrostachyus leaves (source: Najma *et al*., 2015)

11. **Common name:** Devils's trumpet (At'efaris) used to **Conditions treated/controlled:** Abscesses; Ringworm.

Figure: 11 Datura stramonium fruit and *Datura stramonium* leaves and (source: Najma *et al*., 2015)

12. **Common name:** Lemon-scented gum (Shito-barzaf zaf) used to **Conditions treated/controlled:** Lice; Mosquitoes.

Figure:12 Eucalyptus citriodora bark and *Eucalyptus citriodora leaves,* flowers and fruit (source: Najma *et al*., 2015)

13. **Common name:** Tree euphorbia (K'ulk'wal) used to **Conditions treated/controlled:** Pink-eye (kerato-conjunctivitis); Wounds.

Figure: 13 Euphorbia candelabrum stems Tree (source: Najma *et al*., 2015)

14. **Common name:** Lantana (Yemichi-medihanit/ Kese) used to **Conditions treated/controlled:** Liver fluke disease (fasciolosis); Lungworms (ascaris worms).

Figure:14 *Lantana trifolia* flowers and leaves (source: Najma *et al*., 2015)

15. **Common name:** Microglossa (Nech'i-weyinagift) used to **Conditions treated/controlled:** Pox.

Figure:15 Microglossa pyrifolia leaves (source: Najma *et al*., 2015)

16. **Common name:** Drum-stick tree (Mawe/lenkuata) used to **Conditions treated/controlled:** Retained placenta (retained afterbirth).

Figure 16. Moringa stenopetala leaves (source: Najma *et al*., 2015)

17. **Common name:** Myrsine (K'ech'emo/ Fiyelefej) used to **Conditions treated/controlled:** Stomach and intestinal worms; Wounds.

Figure 17. *Myrsine africana* branches, leaves, fruit and flower (source: Najma *et al*., 2015)

18. **Common name:** Tobacco plant (Timbaho/ T'inbaho) used to **Conditions treated/controlled:** Eye diseases and problems, general treatment; Eye worms (thelaziosis); Ticks.

Figure 18. Nicotiana tabacum flowers and leaves (source: Najma *et al*., 2015)

19. **Common name:** Guava (Zeyitum) used to **Conditions treated/controlled:** Diarrhoea.

Figure:19 Psidium guajava fruit and leaves (source: Najma *et al*., 2015)

20. **Common name:** River bean (Alk'im/ Digit'a/ Borefe) used to **Conditions treated/controlled:** East Coast fever; Mastitis (inflammation of the udder, sore teats) and contagious agalactia (reduced milk); Tsetse flies (glossina).

Figure 20. Sesbania sesban leaves, flowers (source: Najma *et al*., 2015)

21. **Common name:** Sodom apple (Imbway) used to **Conditions treated/controlled:** Contagious pleuropneumonia (bovine and caprine); East Coast fever; Foot-and-mouth disease; Heart water (cowdriosis); Liver fluke disease (fasciolosis); Lumpy skin disease; Nasal bot (fly larvae) (Najma *et al*., 2015).

Figure 21. Solanum incanum fruit, flowers and leaves (source: Najma *et al*., 2015)

22. **Common name:** Tree vernonia (Grawa) used to **Conditions treated/controlled:** Bloat (tympany); broken bones (fractures); East Coast fever; Foot-and-mouth disease; Foot rot.

Figure 22. Vernonia amygdalina leaves and flowering buds source: Najma *et al*., 2015)

23. **Common name:** Ginger (Jinjibil/ Zinjibil) used to **Conditions treated/controlled:** Diarrhoea; Stomach and intestinal worms.

Figure: 23 Rhizomes of *Zingibil officinale (*source: Najma *et al*., 2015)

6. Intellectual Property Rights (Ipr)

Traditional practices can be the starting point for the development of technologies, especially commercial drugs. The following activities can help ensure that the originators of the knowledge benefit from its wider adaptation and use (Rinald, 2009). 1) Lobby for policies and legalisation to address the protection of the local flora from overexploitation and the issue of intellectual property rights. 2) Inform healers and other community members on intellectual property rights (IPR) issues. 3) Provide name of informant (or local innovator) for any piece of information (e.g., a local practice, a method) that is not common knowledge in community. 4) Help local people to publish the information they provide under their name. 5) This way it would be possible to pinpoint to specific individuals or groups as originators if a remedy turns out to be so valuable that patency issues arise. 6) Compensate local people for their information through: 1) Using the information to further village development. 2) Making a donation to improve village infrastructure. 3) Paying informants or village in cash or kind. 7) Return the information on Ethnoveterinary medicine so that local people can access and benefit from it through: 1) Storing the information in simple files managed by villagers themselves. 2) Writing reports in simple language and providing copies to the communities. 3) Preparing slideshows or videos. 4) Developing educational materials. 8) Link with organisations that have experiences in intellectual property rights. Examples: International center of insect physiology and ecology (ICIPE) in Nairobi, Research Affiliates Fundamental Index (RAFI) in Canada, and the Honey Bee group in India (for addresses, see below). Furthermore, in some countries (e.g., Philippines) there are Nongovernmental organizations (NGOs) focusing specifically on legal issues relating to indigenous knowledge, local resources and property rights (Sri and Vikrama, 2010).

7. Ethnoveterinary Versus Modern Medicine

Ethnoveterinary medicine' contrasts the knowledge developed by local livestock holders from the scientific or 'allopathic' veterinary medicine taught at universities. Both are dynamic and changing. Like scientific veterinary medicine, Ethnoveterinary practices have been developed through trial-and-error and deliberate experimentation (Thobela *et al*., 2015).

But Ethnoveterinary medicine is developed by farmers in fields and barns, rather than by scientists in laboratories and clinics. It is less systematic and less formalized, and is usually transferred by word of mouth rather than in writing (Sarasan *et al*., 2011). Ethnoveterinary information is in danger of extinction because of the current rapid changes in communities all over the world. In fact, many communities nowadays use a mix of local and modern practices (Stevenson *et al*., 2010). Promoting the conservation and use of Ethnoveterinary medicine does not mean downgrading or ignoring the value of modern medicine and attempting to replace one with the other. However, it does mean recognizing that both types have their strengths and limitations. In some instances, they complement each other, in others, local practices will be the better choice, and again in others modern practices should be recommended (Tyasi *et al*., 2015).

8. Methods Of Administering/Routes

Common methods for administering Ethnoveterinary medicines are described below (Najma *et al*., 2015).

8.1. Drenching: This involves the oral administration of a medicine in liquid form. After measuring the medicine it can be given to an animal using a plastic drink bottle, a bottle gourd or with a calabash spoon.

8.2. Adding medicine to feed and drinking water: Medicines can be added to the feed and water of sick animals that are kept isolated from other animals while they eat and drink. To ensure the full dose is taken, medicine may be mixed with or sprinkled on an initial portion of feed that is offered to the animal, which is then followed by the remainder of the feed. Similarly, liquid medicines may be mixed with an initial quantity of drinking water.

8.3. Fumigation: The use of smoke or fumes to drive away or kill insects and other pests is common. Powdered material or dried leaves, dung, bark, etc., are burnt in clay pots or on the open ground. The smoke engulfs the sick animal or the entire herd. Animal houses may also be fumigated.

8.4. Steam application: Medicinal plants can be added to boiling water and the animal exposed to the

steam. Placing a hot rock into the water will keep it on the boil in order to maintain steam production.

8.5. Nasal and eye drops: Liquid medicines can be applied to eyes or nostrils with a dropper, straw or folded leaf.

8.6. Skin application: Various methods are used. Techniques include the following: 1)Poultices - a paste is made by grinding seed, fruit, leaves and/or roots, etc., and adding a small quantity of water. The paste is applied to the skin and sometimes covered by bandages or strips of banana leaf. Applications may be renewed at regular intervals. 2) Compress - a piece of cloth impregnated with medicine is pressed to the skin. The cloth may contain a warm stone for 'warm' treatments. 3) Powder - an animal may be dusted with a powdered medicine. 4) Lotions and ointments - lotions and ointments may be massaged into the skin. Ointments are traditionally prepared by mixing plant materials with animal fat. However, vegetable oils, Vaseline and Lanoline can also be used. 5) Bathing - animals may be washed with liquid medicines, either their whole bodies or just the affected areas. 6) Spraying - animals can be sprayed with liquid medicines.

8.7. Anal application: To protect against infection, the administrator should wear plastic gloves or put clean plastic bags over their hands, having first washed their hands and clipped their nails (hands should be washed after administration also). Powdered medicine made into a small ball is carefully pushed into the animal's anus. If the ball is dry, it may be dipped in water or oil to ease entry. Today, young Ethnoveterinary practitioners sometimes use needleless syringes to introduce liquid medicines into the anus (Yared *et al*., 2014).

9. Conclusion

Small-scale farmers use both conventional and non-conventional medicine to treat livestock diseases, in order to improve livestock production. However, most of them are illiterate thus they cannot follow the procedures of drug administration properly, as much as they find conventional drugs to be expensive. Therefore, resource-limited farmers use ethno-veterinary medicines as their alternative remedy, because they find ethno-veterinary medicines to be cheap, easy to access and the procedures are easy to follow when administering as compared to conventional medicine. Although herbal preparations are crude and could potentially be toxic. So based on its conclusion the following recommendations are forwarded:

- Research is therefore needed to determine optimal doses and concentrations of the preparations and to identify the side effects of the remedies.
- Moreover, the efficacy of the preparations, techniques, and practices need to be investigated to identify promising plants for use in livestock development proposals.
- The documentation and conservation of medicinal plants is therefore highly recommended.

Acknowledgements

We authors would like to extend sincere acknowledgment to veterinarians, plan cultivators and farmer in the study districts, for their helps during reviewing this paper, for instance collecting data. We authors are also grateful to all respondents/ informants interviewed in this review.

Corresponding Author:
Abebe Mequanent
Department of Veterinary Clinical Medicine
College of Veterinary Medicine and Animal Science
Tewodros Campus, University of Gondar
Gondar, Ethiopia, P.o. Box: 196
Telephone: +251918220138
E. mail: abebemequanent@gmil.com

References

1. Balakrishnan, V.M. (2009): Ethno veterinary Studies Among Farmers in Dindigul District Tamil Nadu, India: *Global Journal of Pharmacology*, 3 (1):15-23.
2. Köhler, R.I. (2001): Personal communication to first author during visit of field projects of the non-government organization Lokhit Pashu-Palak Sansthan in Pali District, Rajasthan, India.
3. Marandure T.C. (2016): Concepts and key issues of ethnoveterinary medicine in Africa: A review of its application in Zimbabwe: African journal of Agricultural Research, vol. 11(20), pp1836-1841.
4. Martin, M. E., Mathias, K.J. and McCorkle, C.M. (2001): Ethnoveterinary medicine: Anannotated bibliography of community animal healthcare. ITDG Publishing, London, UK.
5. Masikati P.T. (2010): Improving the water productivity of integrated crop-livestock systems in the semi-arid tropics of Zimbabwe: an ex-ante analysis using simulation modeling. http://www.zef.de/fileadmin/webfiles/downloads/zefc_ecology_development/eds_78_masikati_text.pdf Accessedon February 12, 2012.
6. Masimba, E.S., Mbiriri, D.T., Kashangura, M.T. and Mutibvu, T.U. (2011): Indigenous practices for the control and treatment of ailments in Zimbabwe's village poultry. *Livest. Res. Rural Dev*, 23:12-25.
7. Mathias, E.S. (1995): Recording indigenous knowledge: An overview. *In:* J. Schneider (ed.).

Indigenous Knowledge in Conservation of Crop Genetic Resources. Proceedings of an international workshop held in Cisarua, Bogor, Indonesia, Jan. 30- Feb. 3, 1995. CIP ESEAP/CRIFC, Bogor, Indonesia. Pp. 19-25.

8. Mathias, E.S. (1994): Importance and use of indigenous knowledge in sustainable development: A training module. *International Institute of Rural Reconstruction (IIRR), Silang, Philippines.*
9. Mlambo, T.U., Mbiriri, D.T., Mutibvu, T.K. and Kashangura, M.T. (2011): Village chicken production systems in Zhombe communal area of Zimbabwe. *Livestock Resource Rural Developments*. 23 (154).
10. Najma, D.J., Abiy, Y.Z., Ermias, A.V., Beatrice, T.O. and Ramni J.L. (2015). Traditional Ethnoveterinary medicine in East Africa: a manual on the use of medicinal plants. *The World Agro forestry Centre (ICRAF), Nairobi, Kenya, Pp.188-218.*
11. Nalule, A.S., Mboria, J.M., Olila, D.J. and Kimenju, J.W. (2011). Ethnopharmacological practices in management of livestock helminthes by pastoral communities in the dry lands of Uganda. *Livestock Research for Rural Development*.
12. Rinald, M.B. (2009): Mapping poverty and livestock in the developing world. *International Livestock's Resource Institute Report*.56: 123 - 134.
13. Sarasan, V.K., Sileshi, G.W., and Stevenson, P.C. (2011): The application of phytochemistry and in vitro tools to the sustainable utilization of medicinal and pesticidal plants for income generation and poverty alleviation. *Plant Cell Reproduction*.30:1163-1172.
14. Sri, B.N. and Vikrama, C.P. (2010): Ethnoveterinary Practices in India – A Review: Journal of Veterinary World, 2010, Vol.3 (12):549-551.
15. Stevenson, P.C., Nyirenda, S.P. and Veitch, N.C. (2010): Highly glycosylated flavonoids from the pods of Bobgunnia madagascariensis. *Tetrahedron Letters*, 51:4727-4730.
16. Thobela, L.T., Masibonge, G., Ning, Q. and Zhi, C.L. (2015): A review on ethno-veterinary and veterinary medicines used to treat livestock of communal farmers. *Journal of Agricultural Economics, Extension and Rural Development: ISSN-2360-798X, Vol. 3(5): pp* 289-292.
17. Tyasi, T.L., Zhi-Chao, L.V., Gxasheka, M.D. and Nkohla, M.B. (2015).Effectiveness of elephantorhiza elephantine as traditional plant used as the alternative for controlling coccidian infections in goats. *Journal of Biology Agriculture Healthcare,* 5(8): 163-167.
18. Wazala, W.K. Zessin, K.H., Kyule, N.M., Baumann, M.P., Mathias, E.B. and Hassanali, A.M. (2005): Ethnoveterinary medicine: a critical review of its evolution, perception, understanding and the way forward. *LRRD* Pp, 17:11.
19. Yared, Y.J., Demissew, B. H. and Wubeante, Y.A. (2014): Ethnoveterinary medicines in four districts of Jimma zone, Ethiopia: cross sectional survey for plant species and mode of use. *Biological medical center veterinary research pp, 10:76.*

4/10/2017