

## Ongoing Case Study One Health Assessment of Antimicrobial Resistance of Ethno-Veterinary Alternatives among Pastoralists in Nigeria

**Babalobi Olutayo Olajide\* and Olurounbi Deborah Iseoluwa**

*Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria*

**\*Corresponding Author:** Babalobi Olutayo Olajide, Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.

**Received:** May 02, 2022; **Published:** May 25, 2022

### Abstract

With the first author's academic background and Research Focus of Pastoralism, Epizootiology (Veterinary Epidemiology) and One Health, he has supervised an Ethnoveterinary Masters Project of the second author and is supervising her ongoing PhD Thesis.

The purpose of this ongoing PhD study is first, to collaborate with expert facilitators in study area who are active from other disciplines, in a joint effort to carry out harmonized interdisciplinary research of antibiotics use and resultant resistance; to show the relationship of antibiotic used in animals to humans, and to the environment, and by that inform the public on the use of antibiotics and resistance, and influence the government in making policies that safeguards animal, human and environmental health.

Second, suggest useful ways of imbibing use of ethnoveterinary medicine as alternative solutions against antimicrobial resistance.

Findings from previous studies indicate that ethnoveterinary practices are readily available in study area and can complement conventional veterinary medical practices, but there is need to standardize modes of preparation and application of the traditional practices. Further research on the active ingredients and their quantities in the ethnoveterinary alternative materials becomes scientifically necessary so as to guide their usage.

**Keywords:** *Case Study; Ethnoveterinary Alternatives; One Health Assessment; Antimicrobial Resistance; Pastoralism, Nigeria*

### Abbreviations

ANOVA: One-Way Analysis of Variance; DVM: Doctor of Veterinary Medicine; ELISA: Enzyme Linked Immunosorbent Assay; EVFS: Eruwa Veterinary Field Station; EVM: Ethnoveterinary Medicine; FVM: Faculty of Veterinary Medicine; HPLC: High Performance Liquid Chromatography; LGA: Local Government Area; MVPH: Masters in Veterinary Public Health; MPVM: Masters in Preventive Veterinary Medicine; PhD: Doctor of Philosophy; SPSS: Statistical Package for Social Sciences; TLC: Total Leucocyte Count; VTH: Veterinary Teaching Hospital; UI: University of Ibadan, Nigeria; WHO: World Health Organization

### Introduction

The recently enacted Animal Disease Control Act 2022 of Nigeria [1], is among others, for the purpose of....prevention of antimicrobial resistance through the control and regulation of the use and administration of...veterinary medicinal products and chemicals... for the enhancement of animal welfare and food safety.

Likewise, Nigeria's National Action Plan for Antimicrobial Resistance, 2017-2022 [2]; with particularly reference to:

- Strategic intervention 2: One health AMR surveillance and research (2<sup>nd</sup> Focus area of Country-specific objective- page 22),
- Strategic intervention 5.2.1 Support AMR researches at universities and relevant research institutes. page 88,
- 5.2.1.1.2: Encourage collaboration between institutions and among Researchers within the One Health System - page 88,
- Strategic intervention 5.3.1 of Operational Plan: Encourage research on and development of alternatives to antibiotic use- page 89; also refers.

This article proposes expanding a previous Master of Veterinary Public Health MVPH research project of the second author: (Olurounbi Deborah Iseoluwa (2016): Assessment of Ethnoveterinary Knowledge among Fulani Pastoralists of Eruwa, Ibarapa LGA. Oyo State Nigeria), carried out under the supervisor of the first author, to the assessment of the antimicrobial resistant features of the identified Ethnoveterinary alternatives (2022 to 2025) within the precincts of the Eruwa Veterinary Field Station EFVS (70°32'59" N27°0'0"E, University of Ibadan, Nigeria UI; under the supervision of the first author, who was also Chairman of the EVFS 2007-2009, 2014-2021.

### Ethnoveterinary medicine

Over the centuries, people have developed their own ways of keeping animals healthy and productive, using age old home remedies, surgical and manipulative techniques, husbandry strategies and associated magico-religious practices. Taken together these constitute what is now known as Ethnoveterinary Medicine [3].

Ethnoveterinary medicine or ethnoveterinary research was defined by McCorkle in 1995 as: "The holistic, interdisciplinary study of local knowledge and its associated skills, practices, beliefs, practitioners, and social structures pertaining to the healthcare and healthful husbandry of food, work, and other income-producing animals, always with an eye to practical development applications within livestock production and livelihood systems, and with the ultimate goal of increasing human well-being via increased benefits from stock raising" [3,4].

At times, EVM is referred to as veterinary anthropology [5] or traditional animal health care and practices [6]. "Veterinary Anthropology" was coined in the 1980s for a particular approach to animal health care, which was researched through "using the basic repertoire of anthropology's research skills and techniques, including observation, interview and participation" [7].

In Nigeria, pastoralists are known to treat animal diseases with herbs and other traditional medical practices before the advent of conventional medicine [8].

Traditional medical and veterinary practices remain relevant and vital in almost all cultures in Nigeria due to absence or inadequate provision of modern medical services especially in hard-to-reach rural areas [9]. Ethnoveterinary medical practice is widespread among pastoral herdsmen and village livestock keepers in northern Nigeria where most of the country's livestock are concentrated [10].

For most of these livestock owners, conventional veterinary inputs and services are not readily available and, where available are relatively expensive. Therefore, they are left with traditional choices which are locally available and affordable, with the held belief that they are more efficacious [11].

In recognition of the fact that Fulani pastoralists possess considerable existing veterinary knowledge and traditional oral history of herbal and non-herbal remedies and their application in livestock disease management, veterinarians, of recent, have intensified efforts towards harnessing this knowledge for authentication and preservation [12].

Currently and recently, Nigeria repealed the Animal Diseases (Control) Act, Cap. A17, Laws of the Federation of Nigeria, 2000 [13] and enacts the Animal Diseases (Control) Act 2022 [1] for the purpose of prevention, detection, control and eradication of infectious and contagious transboundary and zoonotic animal diseases, prevention of antimicrobial resistance through the control and regulation of the use and administration of veterinary biologics, veterinary medicinal products and chemicals in animals, animal products, medicated animal feeds, sales and distribution of pet foods, veterinary medical devices, other veterinary products, and for the enhancement of animal welfare and food safety.

### **One health**

'One Health' is an approach to designing and implementing programs, policies, legislations and researches in which multiple sectors communicate and work together to achieve better public health outcomes. Many of the same microbes infect animals and humans as they share the same ecosystems, they live in. Physicians, pharmacists, veterinarians, patients and farmers all contribute to the overuse of antimicrobials [14]. Efforts by just one sector cannot effectively prevent or eradicate the problem.

Drug resistant microbes can be transmitted between animal and human through direct contact or contaminated materials (fomites), so to effectively contain this, a well-coordinated approach in human and in animal is required [15]. Mitigating resistance will require coordination across sectors. Many professionals with a range of expertise who are active in different sectors, such as public health, animal health, plant health and the environment, should be collaborated with, to support One Health approaches [16].

Although rigorous studies have been conducted in some disciplines, there has been a lack of serious and harmonized interdisciplinary effort to expand on the corpus of knowledge, which should be used to inform public policy.

### **Antimicrobial resistance (AMR)**

Antimicrobial Resistance (AMR) is defined as the resistance of a microorganism to an antimicrobial medicine to which it was previously sensitive [17].

Antimicrobial resistance AMR occurs when bacterial populations evolve in the presence of an antibiotic medicine; this leads to treatments becoming either less efficient or completely ineffective [18].

AMR is one of the greatest threats to global health, development and food security [16]. Antibiotics are used in food animals to treat clinical disease, to prevent and control common disease events, and to enhance animal growth [19]. The use of antibiotics in animals now outstrips that in humans; this means that new resistance mutations are now more likely to arise in other animals than in humans [20].

Antibiotic-resistant bacteria of animal origin have been observed in the environment surrounding livestock farming operations, on meat products available for purchase in retail food stores, and as the cause of clinical infections and subclinical colonization in humans. Antibiotic use in animals can have direct and indirect effects on human health: direct effects are those that can be causally linked to contact with antibiotic-resistant bacteria from food animals, and indirect effects are those that result from contact with resistant organisms that have been spread to various components of the ecosystem (e.g. water and soil) as a result of antibiotic use in food animals [21].

Evidence that antibiotic use in food animals can result in antibiotic-resistant infections in humans has existed for several decades. Given the scale of the antibiotic resistance problem and the demonstrated role of agricultural antibiotic uses in this impending public

health crisis, adequate support for research specific to the role of agricultural uses of antibiotics in the development of resistance must be a national priority [21].

To result in a useful and complete list of research priorities, the agenda must include contributions by experts in basic sciences (e.g. genetics and microbiology), clinical sciences (e.g. veterinary medicine and human medicine), public health (e.g. epidemiology and nursing), social sciences (e.g. anthropology and sociology), economics (e.g. health and agriculture), and public policy (e.g. legislative and regulatory) [21].

### Study challenge

Nigeria is a setting where several healthcare options (medical pluralism), including orthodox medicine; public, private operate freely [22]. Also, antimicrobial overuse and resistance is recognized as one of the most prevalent conditions in Livestock production in Nigeria. The high population density of modern intensively managed livestock operations results in sharing of both commensal flora and pathogens, which can be conducive to rapid dissemination of infectious agents. As a result, livestock in these environments commonly require aggressive infection management strategies, which often include the use of antibiotic therapy [21].

The official AMR policy in Nigeria is the National Action Plan for Antimicrobial Resistance, 2017-2022 [2].

### Study purpose

The purpose of this study is first, collaborate with relevant expert facilitators who are active from other disciplines, in a joint effort to research antibiotics use and resultant resistance; show the relationship of antibiotic used in animals to humans, and to the environment, and by that inform the public on the use of antibiotics and resistance, and influence the government in making policies that safeguards animal, human and environmental health.

Second, suggest useful ways of imbibing use of ethnoveterinary medicine as alternative solutions against antimicrobial resistance.

### Study area

The study area is Eruwa, Ibarapa East LGA, Oyo state, Nigeria. Eruwa (70°32'59" N27°0'0"E) is a town and the headquarters of Ibarapa East LGA located in Oyo state, South West of Nigeria. It is bounded in the north by Iseyin; in the east by Ibadan and in the south by Ogun state. It is 72 km south west of Ibadan and 60 km north east of Abeokuta:

- i. The main study area is EVFS, Eruwa, Ibarapa East LGA, Oyo State, South West of Nigeria, consisting of a Veterinary Teaching Hospital VTH clinic/office in Eruwa town located at Latitude 70°. 369'N and Longitude, 30° 4.197'E along Anko Road within Eruwa town. It is the Field Station of the Faculty of Veterinary Medicine, University of Ibadan;
- ii. It expands to include human medical subjects from the adjoining Community Health Centre, Igboora, (Ibarapa Central LGA), Ibarapa Project, College of Medicine, University of Ibadan, Nigeria;
- iii. The third adjacent Ibarapa South LGA, Oyo State, Nigeria, where veterinary and human subjects are serviced by i and ii above respectively (Figure 1).

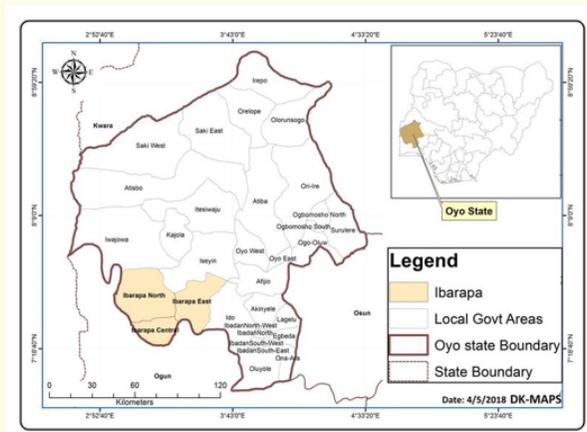


Figure 1: The three Ibarapa LGAs, Oyo State Nigeria which form the study area.

## Proposed Methodology

In this work, a mix of quantitative and qualitative methods will be used in gathering data. The incidences of antimicrobial residue in beef, mutton, goat-meat, chicken, egg and fish are more amenable to data collection by quantitative methods; the incidences of antimicrobial resistance in live animals and humans are more amenable to data collection by qualitative methods.

Participant Epidemiology/Epizootiology observations [23-25], questionnaire, semi-structured interviews and key informant's interview more suited in the case of attitudes and misconceptions of antimicrobial use and resistance, and to use of orthodox and ethnoveterinary antimicrobial. Interview transcripts will be deductively and inductively coded. Main themes will be identified using iterative thematic analysis.

## Research team

Multidisciplinary Multi-Institutional One Health Study Team of Supervisor/Team Leader, Co-Supervisor, Study Student, Field Coordinator, Para-veterinarian, Veterinary Pharmacologist, Human medical doctor, Human Community Nurse, Community Pharmacist, Sociologist/Extension officers, Ecologist/Environmental scientist, Animal Scientists, Agricultural Economist, Students of Oyo State College of Agriculture, Eruwa on Industrial attachment, shall be drawn up of researchers from:

- Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Ibadan, Nigeria.
- Eruwa Veterinary Field Station, Faculty of Veterinary Medicine, University of Ibadan, Nigeria.
- Department of Veterinary Pharmacology and Toxicology, Faculty of Veterinary Medicine, University of Ibadan, Nigeria.
- Community Health Centre, Igboora, (Ibarapa Central Local Government Area), Ibarapa Project, College of Medicine, University of Ibadan, Nigeria.
- State Ministries of Agricultures, Environment and Health.
- Local Government.
- Department of Animal Science, Faculty of Agriculture. University of Ibadan, Nigeria.
- Agricultural Economist from the Department of Agricultural Economics, University of Ibadan, Nigeria.
- Students of Oyo State College of Agriculture, Eruwa on Industrial attachment.

## Procedure:

Epidemiological blood samples the following subjects for this study will be taken from:

- i. Rural non- livestock-rearing community dweller
- ii. Rural livestock-rearing community dweller
- iii. Rural Pastoralists
- iv. Rural Commercial poultry farmers

- v. Rural Commercial fish farmers.

Epizootiology (Veterinary Epidemiology) samples will be taken as follows:

- i. Livestock blood, tissue and parasites of ii and iii above;
- ii. Fowl and egg samples from iv above (poultry farms);
- iii. Fish samples.

A total of 500 samples made up of:

- i. 250 human samples from i-v above and
- ii. 250 animal- 50 cattle, 50 sheep/goat, 50 chicken, 50 eggs, and 50 fish) tissues to be collected from ten (10) different cattle, sheep and goat, poultry and fish farms respectively, for epidemiological/epizootiological assessments, using convenience sampling method.

### **Interviews**

The One Health Team above will respectively conduct the various interviews highlighted below:

Primary data will be collected through interviews conducted with

- a. Pastoralists (20), community livestock keepers (200) and practicing veterinarians (5) within the precincts of Eruwa Veterinary Field Station, (Ibarapa East Local Government Area) study area for
  - I. Knowledge and incidence of use of antimicrobial and ethnoveterinary medicine in animals
  - II. Knowledge and incidence of antimicrobial and ethnoveterinary medicine resistance in animals;
- b. Ten (10) Relevant human health practitioners (10) and samples of human population (250) within the precincts of the respective Community Health Centre, Igboora, (Ibarapa Central Local Government Area) for
  - I. Knowledge of zoonotic diseases and use of common antimicrobial drugs especially for zoonotic human diseases;
  - II. Knowledge and incidence of resistance to antimicrobials especially for human zoonotic diseases.

Environmental scientists will carry out soil, water tests of the environment of farms that uses ethnoveterinary antibiotics as against orthodox antibiotics.

Laboratory *in vitro* test of medicinal plants which are endemic in study areas, for efficacy in some experimentally induced conditions will be carried out using Laboratory rats.

Poultry birds (50) and fish (50) will be reared from day old and tadpole respectively, using ethnoveterinary medicine in preventing and treating diseases, and the tissues will be tested for residue of antimicrobial properties. ELISA, TLC, and HPLC will be used to test and detect presence of antimicrobial residues in different species and tissues.

Modern veterinary health curative systems’ effects on the environment will be compared with ethnoveterinary medicine’s effects.

Secondary data will be obtained from animal and human clinics in study area.

**Data analysis:** The Statistical Analysis System (SAS® software, 2010, Cary, NC, USA) (general linear models programme) will be used to analyze data obtained for the antimicrobial residues in different species and tissues detected by ELISA, TLC, and HPLC at 95% significance level ( $p \leq 0.05$ ). The two methods’ residue content (orthodox and ethnoveterinary) will be compared using chi-square test. One-way analysis of variance (ANOVA) test will be used to determine the significant difference between the antimicrobials’ residue at  $p < 0.05$ . Correlations between the different treatment methods and the antimicrobial residue will also be analyzed statistically using the SPSS software (version 16; SPSS Inc., Chicago, IL, USA) and values of  $p < 0.05$  will be considered and or correlated.

**Budget**

A total of sixteen thousand, one hundred and eighty dollars only (\$16,180.00) is estimated for the study- please see the accompanying attachment.

**Expected result**

From previous studies [10,12,14,23-25] and previous MVPH research project of the second author, expected are the following are expected:

- i. Ethnoveterinary plants and other products will be identified and documented.
- ii. Orthodox veterinary drug acts fast, is already made, widely available, and affordable.
- iii. Both the elderly and the younger generation, making them use more of the Orthodox or modern than the traditional ethnoveterinary medicine.
- iv. Rich ethnoveterinary knowledge among elderly respondents and poor knowledge among the younger generation respectively.
- v. Commercial modern and government policy-back ethnoveterinary pharmaceuticals are a feasible viable venture.

**Study time table for completing study**

	2022				2023				2024			
	Jan- Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan- Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan- Mar	Apr-Jun	Jul-Sept	Oct-Dec
Literature Review	█	█	█	█	█	█	█	█	█	█	█	█
Research Proposal	█	█	█	█								
Development of tools			█	█	█	█	█	█				
Data collection					█	█	█	█	█	█		
Analysis of Data					█	█	█	█	█	█		
Write-up		█	█	█		█	█	█	█	█	█	█
Submission of Result												█

## Discussion

Ethnoveterinary knowledge rest with the elderly and there is increasing dependence on orthodox Veterinary drugs; and products leading to the knowledge “ARE” not being properly passed down to the next generation.

During the focus group discussion among the elderly, it was mentioned that younger generation are not interested, and do not know the ethnoveterinary practice as the elders do and the elderly are also fast abandoning the practice of ethnoveterinary medicine due to the advantages gotten from Orthodox veterinary medicine It was said that they have grown lazy and it is hard to revert to the strenuous methods of plucking plants (in the case of plants), then preparing it and then having to repeat the process for long time has discouraged their frequent use of Ethnoveterinary.

Traditional Veterinary practices have several advantages over orthodox medicine. In most, they are easily available, cheap, accessible, and culturally appropriate [5]. Cost, inaccessibility and other problems like side effects associated with conventional western animal health care system have encouraged constant dependence on such traditional rural wisdom in this field [26].

Giving reasons that Ethnoveterinary knowledge was said to be a common knowledge in the olden days among the Eruwa Fulani pastoralists because the white people were available only twice in the year to treat and vaccinate the livestock so, they had to care for their animals using Ethnoveterinary medicine all year round, hence the parents passed the knowledge down actively to the children. In the absence of funds, farmers face the challenge of scarcity, erratic supply and/or prohibitive costs of synthetic drugs or veterinary services and they usually revert back to more appropriate and sustainable traditional systems of animal health care [27].

Conventional medicines have been so abused and thus creating problems of drug resistance. This is common among the pastoralists of Eruwa, as conventional drug is available in the *Kara* and they treat their animals themselves most of the time. Traditional Veterinary practices have several advantages over orthodox medicine. In most, they are easily available, cheap, accessible, and culturally appropriate [5].

## Conclusion

Findings indicate that ethnoveterinary practices are readily available and can complement conventional veterinary medical practices, but there is need to standardize modes of preparation and application of the traditional practices. There is rich Ethnoveterinary knowledge among Elderly Fulani pastoralists in Eruwa, and poor knowledge of Ethnoveterinary medicine among the younger generation respectively.

Some plants and other Ethnoveterinary products that are being used in treatment of diseases among Fulani pastoralists in Eruwa have been identified and documented.

Further research on the active ingredients and their quantities in the ethnoveterinary materials becomes scientifically necessary so as to guide their usage [23,24].

## Bibliography

1. Animal Disease Control Act 2022. Nigeria.
2. Nigeria’s National Action Plan for Antimicrobial Resistance, 2017-2022. Federal Ministries of Agriculture, Environment and Health. Nigeria (2017).
3. McCorkle CM. “Back to the future: Lessons from ethnoveterinary RD&E for studying and applying local knowledge”. *Agriculture and Human Values* 12 (1995): 52-80.

4. [https://en.wikipedia.org/wiki/Ethnoveterinary\\_medicine](https://en.wikipedia.org/wiki/Ethnoveterinary_medicine).
5. Mathias-Mundy E and McCorkle M C. Ethnoveterinary Medicine: An annotated bibliography. Bibliographies in Technology and Social Change, No. 6, Technology and Social Change Programme, IOWA State University, Ames, IOWA 50011 USA (1989).
6. Mathias-Mundy E., *et al.* Introduction. In: Ethnoveterinary Research and Development. Intermediate Technology Publications. London (1996): 1-23.
7. Köhler-Rollefson Ilse and Bräunig Juliane. Anthropological Veterinary Medicine: The Need for Indigenizing the Curriculum. Paper presented at the 9<sup>th</sup> AITVM Conference in Harare, Zimbabwe (1998).
8. Nwude N and Ibrahim MA. "Plants used in traditional veterinary medical practice in Nigeria". *Journal of Veterinary Pharmacology and Therapeutics* 3.4 (1980): 261-273.
9. Kudi AC and Myint SJ. "Antiviral activity of some Nigerian medicinal plant extracts". *Journal of Ethnopharmacology* 68.1-3 (1999): 289-294.
10. Alawa JP, *et al.* "Ethnoveterinary medical practice for ruminants in the sub humid zone of northern Nigeria". *Preventive Veterinary Medicine* 54.1 (2002): 79-90.
11. Rashid MH., *et al.* "An ethnoveterinary survey of medicinal plants used to treat cattle diseases in Birishiri area, Netrakona district, Bangladesh". *Advances in Natural and Applied Sciences* 4.1 (2010): 10-13.
12. Offiah NV., *et al.* "Survey of herbal remedies used by Fulani herdsman in the management of animal diarrhea in Plateau State, Nigeria". *Journal of Medicinal Plants Research* 6.312 (2012): 4625-4632.
13. Animal Disease Control Acts Cap 47 1988.
14. Woolhouse M and Farrar J. "Policy: An intergovernmental panel on antimicrobial resistance". *Nature* 509.7502 (2014): 555-557.
15. WHO. The World health report: 2004: Changing history (2004).
16. WHO guidelines on use of medically important antimicrobials in food-producing animals. Geneva: World Health Organization. License: CC BY-NC-SA 3.0 IGO (2017).
17. World Health Organization. Fact sheet, 2011. [<http://www.who.int/mediacentre/factsheets/fs194/en/>].
18. Ritchie H. "How do we reduce antibiotic resistance from livestock?" Our World in Data (2017).
19. McEwen SA and Fedorka-Cray PJ. "Antimicrobial use and resistance in animals". *Clinical Infectious Diseases* 34.3 (2002): S93-106.
20. MacKenzie D. "Plan to slash farm antibiotic use may stop spread of resistance". New Hardon A.P, Boonmongkon P, Streefland P, Tan ML. 3<sup>rd</sup> edition. Amsterdam: Het Spinhuis. Applied health research: Anthropology of health and health care. Manual. - 3<sup>rd</sup> rev. ed. 387. Amsterdam: Het Spinhuis ISBN 9055891916 9789055891917 (2001).
21. Landers Timothy F., *et al.* "A Review of Antibiotic Use in Food Animals: Perspective, Policy, and Potential". *Public Health Report* 127.1 (2012): 4-22.
22. Hardon AP., *et al.* "Amsterdam: Het Spinhuis". Applied health research: Anthropology of health and health care. Manual. - 3<sup>rd</sup> revised edition. 387. Amsterdam: Het Spinhuis ISBN 9055891916 9789055891917 (2001).
23. Babalobi OO. "A Participatory Epizootiology Research of Settled Pastoralists in Igangan Grazing Reserve, Southern Guinea Agro-Pastoral Zone, Oyo State, Nigeria: First Report". *Nigerian Veterinary Journal* 32.1 (2011): 16-20.

24. Alhaji NB and Babalobi OO. "Participatory Epidemiology of Ethnoveterinary Practices Fulani Pastoralists Used to Manage Contagious Bovine Pleuropneumonia and Other Cattle Ailments in Niger State, Nigeria". *Journal of Veterinary Medicine* (2015): 460408.
25. Babalobi Olutayo and Nma Bida Alhaji. "Review of Participatory Epizootiology Research of Contagious Bovine Pleuropneumonia at the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Nigeria (2007-2015)". *Journal of Animal Science and Veterinary Medicine* 3.3 (2018): 65-74.
26. Sri Balaji N and Vikrama Chakravarthi P. "Ethnoveterinary practices in India - A review". *Veterinary World* 3.12 (2010): 549-551.
27. Mathias E and McCorkle CM. "Traditional livestock healers". *Revue Scientifique et Technique* 23.1 (2004): 277-284; Discussion 391-401.

**Volume 7 Issue 6 June 2022**

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