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Antibiotic prescription trends in a Tertiary Veterinary Hospital in Nigeria

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Abstract

A six-year retrospective study was conducted using records from case files of patients (Companion and Food Animals) handled at a Veterinary Teaching Hospital in Ogun state, Nigeria, to assess the pattern of antibiotic prescriptions in managing diseases presented to the hospital. There were four hundred and fifty-four (454) antibiotic prescription cases for which twelve (12) antibiotics were used. An antimicrobial susceptibility test was carried out before antibiotic prescription for 5 (1.1%) cases. The most frequently used antibiotics were: oxytetracycline (346; 68.4%), enrofloxacin (75; 14.8%), amoxicillin (31; 6.0%), and doxycycline (20; 4.0%). The frequency of use was less than 3% for each antibiotic. About 91.6% of the antibiotics were prescribed for diseases of infectious origin, 5.7% for non-infectious diseases, while the diagnosis of 2.6% of the antibiotic prescriptions was not specified. Haemoparasitic infections constitute 87.3% of infectious diseases, bacterial and viral infections constitute 7.7% and 5%, respectively. The antibiotic prescription regimen was completed in 38.1% of the cases were not completed in 49.6%, and in 12.3% of the cases, it was not clearly stated whether or not the patients completed the prescription regimen. Oxytetracycline was the most frequently prescribed antibiotic. The highest usage of antibiotics was in the treatment of haemoparasitic infections, and there was a high rate of non-compliance among clients to their prescription regimens. This finding underscores the significance of maintaining patient follow-up and educating clients on the importance of adhering to antibiotic regimens, to reduce the emergence of antimicrobial resistance.

Key Words: antibiotics, prescription pattern, veterinary hospital, antimicrobial sensitivity test, Nigeria

Introduction

Antibiotics play a vital role in veterinary medicine, serving to treat sick animals, manage disease spread, and prevent infections. However, their overuse and misuse are closely linked to the emergence of antimicrobial resistance (AMR) (Mather *et al.,* 2013; Spoor *et al.,* 2013; Chantziaras, 2014; Ward *et al.,* 2014). This global issue of AMR is exacerbated by animal, human, and environmental interactions, facilitating resistance transfer across species boundaries (Van den Bogaard *et al.,* 2001; Forsberg *et al.,* 2012; Ward *et al.,* 2014).

The ramifications of infections from resistant microorganisms are profound, encompassing prolonged and severe infections, heightened mortality rates, extended hospitalizations, nosocomial infection spread, and increased healthcare costs (Ward *et al.,* 2014).

Despite these critical concerns, there exists a significant gap in understanding antimicrobial stewardship among veterinarians, as highlighted by a recent study in Nigeria (Adekanye *et al*., 2020). Moreover, there is a dearth of information regarding antibiotic prescription patterns within Nigerian veterinary facilities. This lack of data poses challenges in tracking antibiotic prescription and usage trends in animals, further complicating efforts to address the overarching AMR crisis.

In light of these knowledge gaps, this study aims to fill the void by providing a detailed examination of antibiotic prescription patterns at the Veterinary Teaching Hospital, Federal University of Agriculture, Abeokuta in Nigeria over a six-year period, spanning from January 2015 to December 2020. By elucidating the specific patterns and trends in antibiotic prescription, this research endeavors to contribute valuable insights into the utilization of antibiotics in veterinary settings and inform targeted interventions to promote antimicrobial stewardship practices.

Materials and methods

Study Design and Population:

This retrospective study involved the review of case files of patients, including companion and food animals, at the Veterinary Teaching Hospital of the Federal University of Agriculture, Abeokuta, Ogun state, Nigeria. The study period was from January 2015 to December 2020.

Inclusion Criteria:

All case files of patients (companion and food animals) where antibiotics were used between January 2015 and December 2020 (n=511) were included in the study.

Exclusion Criteria:

Cases were excluded if:

- Antibiotics were not prescribed or administered.
- The use of antibiotics could not be confirmed or documented.
- The primary treatment did not involve antibiotics.
- There were missing or incomplete data regarding antibiotic usage.
- Cases were outside the specified study period (i.e., before January 2015 or after December 2020).

Ethical Approval and Data Collection:

Ethical approval for this study (Approval reference number: FUNAAB/COLVET/CREC/2021/03/05) was obtained from the Ethical Committee of the College of Veterinary Medicine, FUNAAB. Permission to access and review patient case files was obtained from the Director of the Veterinary Teaching Hospital, FUNAAB.

Data Collection and Analysis

Relevant data, including species and age of patients, diagnoses, antimicrobial susceptibility testing, antibiotic prescription, route of administration, duration of antibiotic usage, and outcome of antibiotic usage, were extracted from the reviewed case files. New codes were assigned to each case to protect patient and client confidentiality.

The extracted data were entered into an Excel spreadsheet and subsequently coded for analysis. Descriptive statistics, including tables of frequencies and percentages, were used to summarize the data. The association between species of animals and the rate of treatment completion was tested using the Chi-Square test. Statistical analysis was performed using the Statistical Packages for Social Sciences (SPSS), and a p-value ≤ 0.05 was considered significant.

Results

During the period under review (2015-2020), there were 454 cases in which antibiotic prescriptions were recorded. Species of companion animals attended to included canine (432; 95.2%) and feline (2; 0.4%); while those of food animals were avian, bovine, laprine, caprine and ovine as shown in Table 1. Patients were treated mainly for diseases of infectious causes (91.6%) and non-infectious causes (5.7%). The diagnoses for 2.6% of the cases were not stated, although antibiotics were prescribed. Among the infectious causes leading to antibiotic prescriptions, haemoparasitic diseases accounted for 87.3%, bacterial and viral diseases each accounted for less than 10% (Table 1). In most cases (98.9%) antibiotic prescriptions were made without laboratory investigations especially culture and antimicrobial susceptibility testing. The most common route of administration of antibiotics was intravascular injection (55.2%) followed by intramuscular injection (33.9%) and oral administration (5.5%). Other routes of administration were subcutaneous, intraocular, auricular, and topical (Table 1).

In all, twelve antibiotics were prescribed for both companion and food animals within the study period. Oxytetracycline (346, 68.4%) was the most frequently prescribed antibiotic followed by enrofloxacin (75, 14.8%) and amoxicillin (31, 6.0%). Others such as doxycycline, penicillin-streptomycin, ciprofloxacin, sulphadimidine, metronidazole, chloramphenicol, gentamicin and tylosin had less than 5% prescription as shown in Table 2.

The trend of antibiotic prescriptions varied over the study period. The highest record of antibiotic prescription was in the year 2019 (39.7%), the least prescription was in 2016 (4.4%) (Table 2).

Combination therapy was adopted for some of the disease management, single antibiotics were also prescribed in some of the cases as shown in Table 3.

The use of antibiotics varied among the different species of animals. Antibiotics were most frequently prescribed for treatment in canines (484; 95.4%), followed by ovines (10; 2%), and laprines (5; 1%). Other species included caprines, felines, avian, and bovine as shown in Table 4.

Table 1. Characteristics of Antibiotic Prescriptions

Characteristics		Frequency (n=454)	Percentage (%)
Antimicrobial susceptibility test	Done	5	1.1
	Not done	449	98.9
Route of administration	Intravascular	280	55.2
	Intramuscular	172	33.9
	Oral	28	5.5
	Subcutaneous	3	0.6
	Intraocular	2	0.4
	Auricular	2	0.4
	Topical	1	0.2
Diagnosis (Based on origin)	Infectious cause	416	91.6
	Non-infectious cause	26	5.7
	No diagnosis	12	2.6
Diagnosis (Based on Infectious cause)	Parasitic	363	87.3
	Bacterial	32	7.7
	Viral	21	5

The antibiotics were prescribed for different durations. They were prescribed for three to seven days (89.7%), less than three days (3.6%), and some were prescribed for more than seven

days (1.2%). Prescription duration was not specified for 5.4% of the cases.

The records showed that some of the patients completed their prescription regimen, some did not, and some others the completion status was not documented. Canine species had the highest frequency of uncompleted prescriptions, followed by ovine, laprine and caprine. There is a statistically significant difference between the different species presented at the veterinary teaching hospital and the antibiotic completion rate (P = 0.021) as shown in Table 5.

Table 6 provides a comprehensive overview of the various outcomes associated with antibiotic usage in the study population, highlighting both successful treatment outcomes and challenges such as patient non-compliance (client absconded hence the patients not completing their antibiotic prescription). The outcome of 9.9% of the antibiotic prescriptions was not known because the medications were either prescribed or dispensed, and there was no follow-up.

Table 2: Trend of antibiotic prescription during the study period

Antibiotics	**2015 n (%)**	**2016 n (%)**	**2017 n (%)**	**2018 n (%)**	**2019 n (%)**	**2020 n (%)**	**Total n (%)**
Oxytetracycline	33 (6.5)	18 (3.6)	29 (5.8)	67 (13.2)	133 (26.3)	66 (13.0)	346(68.4)
Enrofloxacin	2 (0.4)	1 (0.2)	3 (0.6)	14 (2.8)	35 (7.0)	20 (3.8)	75(14.8)
Doxycycline	1 (0.2)	1 (0.2)	0.0 (0.0)	1 (0.2)	9 (1.8)	8 (1.6)	20 (4.0)
Pen-streptomycin	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1 (0.2)	11 (2.2)	0.0 (0.0)	12 (2.4)
Ciprofloxacin	1 (0.2)	1 (0.2)	0.0 (0.0)	5 (1.0)	1 (0.2)	0.0 (0.0)	8 (1.6)
Sulphadimidine	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2 (0.4)	4 (0.8)	6 (1.2)
Amoxicillin	0.0 (0.0)	1 (0.2)	0.0 (0.0)	7 (1.4)	8 (1.6)	14 (2.8)	30 (6.0)
Metronidazole	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5 (1.0)	0.0 (0.0)	0.0 (0.0)	5 (1.0)
Chloramphenicol	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1 (0.2)	0.0 (0.0)	0.0 (0.0)	1 (0.2)
Gentamicin	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1 (0.2)	0.0 (0.0)	1 (0.2)
Tylosin	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1 (0.2)	1 (0.2)
Total	37 (7.3)	22 (4.4)	32 (6.4)	101(20.0)	201(39.7)	113(22.2)	506(100)

Table 3 Number of antibiotics prescribed per case

Number of antibiotics per prescription	**Frequency (n = 454)**	**Percentage (%)**
One	401	88.3
Two	52	11.5
Three	1	0.2

Table 4: Prescription of antibiotics for different animal species

DRUG	Canine n (%)	Feline n (%)	Ovine n (%)	Laprine n (%)	Avian n (%)	Caprine n (%)	Bovine n (%)	Total n (%)
Oxytetracycline	334 (66.0)	1.0 (0.2)	6.0 (1.2)	2.0 (0.4)	0.0 (0.0)	2.0 (0.4)	1.0 (0.2)	346 (68.4)
Enrofloxacin	71 (14.0)	0.0 (0.0)	2.0 (0.4)	2.0 (0.4)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	75 (14.8)
Doxycycline	20 (4.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	20 (4.0)
Pen-streptomycin	10 (2.0)	0.0 (0.0)	1.0 (0.2)	0.0 (0.0)	0.0 (0.0)	1.0 (0.2)	0.0 (0.0)	12 (2.4)
Ciprofloxacin	8.0 (1.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	8.0 (1.6)
Sulphadimidine	6.0 (1.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	6.0 (1.2)
Amoxicillin	26 (5.2)	1.0 (0.2)	1.0 (0.2)	1.0 (0.2)	0.0 (0.0)	1.0 (0.2)	0.0 (0.0)	30 (6.0)
Metronidazole	5.0 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5.0 (1.0)
Chloramphenicol	1.0 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.0 (0.2)
Gentamicin	1.0 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.0 (0.2)
Tylosin	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.0 (0.2)	0.0 (0.0)	0.0 (0.0)	1.0 (0.2)
Total	**483 (95.4)**	**2.0 (0.4)**	**10 (2.0)**	**5.0 (1.0)**	**1.0 (0.2)**	**4.0 (0.8)**	**1.0 (0.2)**	**506 (100.0)**

Table 5 Species and rate of antibiotic completion

SPECIES	Unknown Completion history		Prescription not Completed		Prescription completed	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Canine	38	8.80	217	50.1	178	41.1
Feline	1	50	1	50	0	0
Ovine	3	33.3	3	33.3	3	33.3
Laprine	2	40	3	60	0	0
Caprine	1	25	3	75	0	0
Bovine	0	0	1	100	0	0
P-value		0.021				

Table 6 Outcome of antibiotic therapy

Outcome	Frequency (n)	Percentage (%)
Unknown	45	9.9
Client absconded	211	46.5
Successful treatment	179	39.4
Death of patient	19	4.2

Discussion

The present investigation is a retrospective study on antibiotic prescription pattern in disease management at the Veterinary Teaching Hospital, FUNAAB for six years. The study showed that canine was the most predominant species presented to the clinic during the study period, this aligned with similar research findings (Radford et al., 2011). Other species included ovine, laprine, caprine, feline, bovine and avian. The predominance of canine species over other species could be because dogs are treated more on an individual basis whereas food animals are treated on a herd basis. Hence, bringing dogs to the clinic is more feasible than bringing food animals to the clinic. Veterinarians are usually invited to attend to food animals on farms and record of such visits may not be available in the clinic but on the farms. It is possible that dog owners were more inclined to seek veterinary care for their pets compared to owners of food animals, as suggested by Awosanya and Akande (2015).

The present study revealed that clinicians rarely do bacterial culture and antimicrobial susceptibility testing before prescribing antibiotics for the treatment of diseases. In some cases, blood samples were screened for the presence of haemoparasites before administering antibiotics. Similar studies carried out at the Usmanu Dan Fodio University Teaching Hospital, Sokoto (Agaie *et al.,* 2016), Veterinary Teaching Hospital, Nsukka (Ihedioha *et al*., 2020) and a Veterinary Teaching Hospital in Italy (Escher *et al*., 2011) also reported that antimicrobial agents were prescribed and used in animals without prior laboratory investigations. Oxytetracycline which was the most frequently prescribed antibiotics was used mostly for the treatment of babesiosis; a haemoparasitic condition. Babesiosis is not a bacterial infection, which may account for the prescription of antibiotics (particularly oxytetracycline) without first undergoing antimicrobial susceptibility testing. Antimicrobial susceptibility tests identify the precise antibiotics to which a given bacteria is sensitive or resistant (Bayot and Bragg, 2022). `

Antibiotics were prescribed for the treatment of infectious and non-infectious diseases. The observed high dependence on antibiotics in the management of infectious and non-infectious diseases is similar to earlier reports where it was reported that antimicrobial agents were commonly used in hospitals in Nigeria and other developing countries (Shima *et al*., 2015; Agaie *et al*., 2016; Ihedioha *et al*., 2020; Islam *et al*., 2019). More antibiotics were used in the treatment of haemoparasitic infections, than bacterial and other types of infections. The frequency of prescription of a single-course antibiotic was higher than two and three-course antibiotic prescriptions. In the present study, the frequency of polytherapy was lower than what was reported by earlier authors (Agaie *et al.,* 2016). This could be due to the level of experience of the clinicians, and the usage of broad-spectrum antibacterial agents.

Oxytetracycline which was the most frequently prescribed antibiotic in this present study has been reported to be the antibiotics with the highest usage frequency globally (OIE, 2016). This is also the situation in veterinary hospitals in Nigeria and other parts of Africa (Agaie *et al.,* 2016; Ihedioha *et al*., 2020; Beyene *et al*., 2015). This was followed by enrofloxacin, amoxicillin and doxycycline. It has been reported that clinicians depend more on oxytetracycline in the management of diseases because of its availability and formulation as 'Long Acting' 20% oxytetracycline which is often administered as a single dose at intervals of more than 24 hours thereby making its administration very convenient. In addition, Oxytetracycline is relatively economical and it is available in various dosage forms thereby making it suitable for different animal species of varying ages in various disease conditions.

Although the highest record of antibiotic prescription was in 2019; the trend of antibiotic

prescription was not consistent during the study period. The variation could be due to differences in the total number of cases presented at the Veterinary Teaching Hospital during the study period, the number of cases that required antibiotic therapy and the clinicians' discretion. Frequency and choice of antibiotic prescriptions were different among the various species of animals. The canine specie had the highest frequency. This could be because clients who kept dogs visited the clinic more frequently than livestock farmers similar to reports from Awosanya and Akande (2015). Moreover, diagnosis and treatment of food animals would more likely be done on the farm, with fewer records at the clinic, hence the reason for lower data on food animal records during the study period.

Most of the antibiotics were prescribed for three to seven days, while a few had no recorded prescribed duration. This was probably due to omission on the part of the clinician and could lead to irregularity and antibiotic misuse. Some of the antibiotics were prescribed for less than three days. Exposure to sub-therapeutic doses of antibiotics could contribute to the emergence of antimicrobial resistance (Ahmad et al., 2021). A high percentage of the antibiotics were used for three to seven days, while some were administered for less than three days mainly because the clients stopped taking their animals to the clinic to complete the treatment regimen. This was similar to the report of an earlier study in the Veterinary Teaching Hospital, Nsukka (Ihedioha *et al*., 2020). During the study period, the treatment regimens for prescribed antibiotics were not completed for many of the cases presented. Non-compliance with the prescription regimen could lead to subtherapeutic exposure and consequently the development of resistance traits in exposed bacteria (Ahmad et al., 2021). Ihedioha *et al*. (2020) attributed the high frequency of non-compliance to a lack of knowledge on the part of owners of animals and inefficiency on the part of animal health workers who failed to educate animal owners on the importance of completing the prescription regimens even if the animal patients seem to have recovered from diseases.

In some of the cases, the outcome of antibiotic therapy in animal patients was unknown (not documented). This could be due to the absence of follow-up following the prescription of antibiotics to be administered by clients on their animals at home as outpatients. Similarly, some clients absconded after the initiation of antibiotic therapy. Therefore, the outcome of the antibiotic prescription could not be confirmed. However, in most cases, antibiotic prescription and administration resulted in the successful treatment of the disease conditions presented because the patients recovered.

Conclusion

The study showed the usage of antibiotics in the management of infectious and non-infectious diseases. More antibiotics were used in the treatment of haemoparasitic infections, than bacterial and other types of infections. The study highlighted oxytetracycline as the most frequently prescribed antibiotic.

There was a high rate of non-completion of antibiotic regimen which could result in the emergence of antimicrobial resistance. This result indicates the need for patient follow-up, client orientation, and awareness of antimicrobial resistance to encourage adherence to antibiotic regimens, which can greatly reduce the menace of antimicrobial resistance.

Conflict of interest statement

The authors have no competing interest

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