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Research Article

Antibiotic prescription practice at veterinary pharmaceutical shops and its potential impact on the development of antimicrobial resistance in Moshi, Northern Tanzania

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Abstract

Aim: We aimed to investigate antibiotic prescription practice in veterinary shops and its potential impact on the development of antimicrobial resistance.

Methods: A correlation cross-sectional study was carried out in Moshi, Tanzania. A convenient sampling method was used to enroll 80 study participants and 80 Veterinary pharmaceutical shops selling antibiotics for cattle. The study questionnaire was administered to both pharmaceutical sellers and cattle keepers **Results:** A total of 80 veterinary pharmaceutical shops visited to deliver information about antibiotics sold with or without prescription from veterinary professionals and eighty (80) human participants. Most of the study participant 66/80 (82.5%) responded to started treatment before laboratory diagnosis and diagnosis was mainly based on symptoms and signs 58/80 (72.5%); owners description 17/80 (21.3%) and less frequently on none specific reason 15/80 (6.5%) (X2=77.89, *P*= 0.000, OR=0.875, 95% CI= 0.803-0.947). Tetracycline 30 (100%), Trimethoprim/sulfamethoxazole 10 (100%), and amoxicillin/clavulanic acid 7 (100%) were highly sold unprescribed drugs and no quantity of these drugs was prescribed before selling at Veterinary pharmaceutical shops.

Conclusion: The regulation of Veterinary antibiotic prescription at veterinary pharmaceutical shops has to be a point of discussion and paid greater attention to ensure a sustainable control and reduction of transmission and spread of drug-resistant bacteria in humans and cattle.

Keywords: antibiotic prescription practice, antimicrobial resistance, Veterinary pharmaceutical shops

INTRODUCTION

The misuse and overuse of veterinary drugs in food-producing cattle causes not only environmental pollution and wide food safety concerns but also poses a public health risk of antibiotic resistance that can be disseminated from cattle to human populations.[1,2] The presence of antibiotic-resistant bacteria isolates from both cattle and humans has suggested a presence of resistant bacteria genes that spread from cattle to humans.[2,3] This also plays a role in the dissemination of resistant genes along with food-producing cattle.[3-7]

The previous studies suggested Extended-Spectrum Beta-Lactamase (ESBL) producing bacteria play a role to confer resistance to some antibiotics such as monobactam aztreonam, penicillin, and cephalosporin resulting in therapeutic challenging worldwide.[2,8-10]

Currently, the intensive discussion on antibiotic prescription practice from veterinary pharmaceuticals to food-producing animals particularly cattle is a subject of concern due to the zoonotic spread of resistant bacterial strains between cattle and humans.[2,11-13,14-15] This study has also encouraged the "One Health" approach as suggested by previous studies to ensure elimination of transmission and spread and limiting prescription practice in both veterinary and human medicine.[2]

Several studies have reported irrational use of antibiotics and shortage of veterinary professionals in veterinary medicine as risk factors for the emergence and spread of antibiotic resistance in animals and humans.[1-2,4,16-19] Currently there is little information documented on the antibiotic prescription practice and knowledge of animal keepers in veterinary medicine as the major factors for the development of multi-drug resistance of bacterial isolates in both cattle and humans.

Although there are complex causes of antibiotic resistance, this study aimed to identify and provide baseline information on other factors resulting in the development of antibiotic resistance of bacteria in both cattle and humans residing in one area in Moshi urban, Tanzania. A large scientific consensus is needed for antibiotics used in the treatment and prevention of sporadic emerging and spread of multidrug resistance in both animal and human populations.

METHODS

Study Design and Sampling Process

A correlational cross-sectional study was carried out in Moshi, Tanzania. The study was conducted from October 2014 to May 2015 and involved 80 veterinary pharmaceutical shops and 80 human study participants.

A convenient sampling method was used to enroll 80 study participants who attended at different eighty Veterinary pharmaceutical shops for buying drugs or Agrovet shopkeepers selling the drugs for cattle. All participants signed a consent form and participants were continuously enrolled from the start day until the estimated sample size reached.

Data collection

Structured questionnaires were used to collect information on antibiotics sold at veterinary pharmaceutics without prescription as well as information of knowledge based on usage of antibiotics and laboratory diagnosis of cattle. The trained personnel assisted participants to fill in the questionnaire.

Data Analysis

The data were exported to Statistical Package for Social Sciences (SPSS) version 17.0 (SPSS Inc., Chicago, USA) from Excel for analysis based on the study objectives. The significant differences in the distribution of categorical variables in proportion were compared by Chi-square tests. Fisher's test was used to measure the association between antibiotics sold and prescription practice by performing linear regression. The probability (p) value of less than 0.05 was considered as Statistical significant.

RESULTS

Pharmaceutical shops and participants information

A total of eighty (80) participants were recruited for this study from 80 veterinary pharmaceutical shops visited to deliver information about antibiotics sold with or without prescription from veterinary professionals. Among eighty human participants recruited, farmers (cattle keepers), Veterinary practitioners, Agrovet professionals, business people, Agrovet shopkeepers, and other professional carriers were the main concern of the study as detailed in Tables 1 and 2. Out of 80 participants, 10 were sellers (Agrovet shopkeepers) whereas, 70 were buyers as shown in Tables 1 and 2. They were requested to fill in questionnaires for data collection in Moshi urban.

Table 1: Number of Agrovet shopkeeper (Sellers) and their educational level

Education level	Agrovet shopkeeper
Bachelor's degree	3
Diploma	7
Total	10

Table 2: Number of participants (educational level included) who went to pharmaceutical shops for buying drugs (Buyers)

Education level	Farmer	Veterinary practitioner	Agrovet professional	Business person	Other professionals	Total
Bachelor's degree	0	5	2	0	0	7
Diploma	1	0	7	5	0	13
Primary/ Secondary	23	0	0	11	16	50
Total	24	5	9	16	16	70

Knowledge-based on antibiotic usage and laboratory diagnosis of cattle

Most of the study participant 66/80 (82.5%) responded to started treatment before laboratory diagnosis and diagnosis was mainly based on symptoms and signs 58/80 (72.5%); owners description 17/80 (21.3%) and less frequently on none specific reason 15/80 (6.5%) (X2=77.89, *P*= 0.000, OR=0.875, 95% CI= 0.803-0.947). They also started treatment before laboratory results by using experiences 33 (41.2%), due to lack of knowledge for diagnosis and services availability 22 (27.5%) and 9 (41.2%), respectively, to serve costs and time consuming 8 (10.0%) and 8 (10.0%), respectively (X2=20.53, *P*= 0.425, OR=0.925, 95% CI= 0.867-0.983). They also used unprescribed drugs in order to serve costs 29 (36.2%), due to experience 17 (21.2%) and less frequently 15 (18.8%) due to lack of enough professionals and ignorance on human effects (X2=25.33, *P*= 0.189, OR=0.662, 95% CI= 0.559-0.766). There were few participants 17 (21.2%) who did not know withdraw period compared to the majority 63 (78.8%) of participants who had knowledge on withdraw period although animal products such as milk or meat used before withdraw period (X2=8.814, *P*= 0.117, OR=0.175, 95% CI= 0.095-0.258). This was due to ignorance on human effects 35 (43.8%), cost recovery 25 (31.2%) and lack of knowledge on withdraw period 20 (25.0%) (X2=7.559, *P*= 0.672, OR=0.350, 95% CI= 0.245-0.455) (Table 2).

Table 3: Knowledge based on antibiotic usage and lab diagnosis of cattle among people keeping Cattle

Variable	Frequency	X^2	P-value	OR	CI
Treatment started before lab testing results	66 (82.5%)	9.341	0.96	0.125	0.053 - 0.197
Treatment started after lab testing results	14 (17.5%)				
Diagnosis based on symptoms or signs	58 (72.5%)	77.89	0.000	0.875	0.803-0.947
Diagnosis based on owner's description	17 (21.3%)				
Diagnosis based on none specific reason	5 (6.5%)				
use of unprescribed drugs due to lack of enough professionals	15 (18.8%)	25.33	0.189	0.662	0.559-0.766
use of unprescribed drugs due to cost serving	29 (36.2%)				
use of unprescribed drugs due to ignorance on human effects	15 (18.8%)				
use of unprescribed drugs due to experience	17 (21.2%)				
Treatment started before lab testing results because no lab services were available	9 (11.2%)	20.53	0.425	0.925	0.867-0.983
Experiences were used to start treatment before lab testing results	33 (41.2%)				
Treatment started before lab testing results due to lack of proper knowledge on diagnosis	22 (27.5%)				
Treatment started before lab testing results in order to serve cost	8 (10.0%)				
Treatment started before lab testing results because of time consuming	8 (10.0%)				
Have knowledge on withdraw period	63 (78.8%)	8.814	0.117	0.175	0.095-0.258
Lack the knowledge of withdraw period	17 (21.2%)				
Animal products used before withdraw period in order to recovery Cost	25 (31.2%)	7.559	0.672	0.35	0.245-0.455
Animal products used before withdraw period due to Ignorance on human effects	35 (43.8%)				
Animal products used before withdraw period due to lack of knowledge on withdraw periods	20 (25.0%)				

Key: Lab - Laboratory

Frequency of unprescribed antibiotics sold at Veterinary pharmaceutics

Tetracycline was highly sold and unprescribed drugs 30 (100%) and no quantity of tetracycline were sold prescribed. The other drugs that were sold at Veterinary pharmaceutical shops without prescription were Trimethoprim/sulfamethoxazole and Amoxicillin/clavulanic acid of 10 (100%) and 7 (100%), respectively. Norfloxacin was highly sold unprescribed 16 (88.9%) as compared to 11.1% of Norfloxacin solid with prescription. About 4 (80%) of Gentamicin was solid without prescription and 1 (20%) was prescribed. Ciprofloxacin was equally solid prescribed 1 (50%) and unprescribed 1 (50%) drug whereas, 6 (75%) and 2 (25%) of Amikacin being unprescribed and prescribed, respectively (Figure 1).

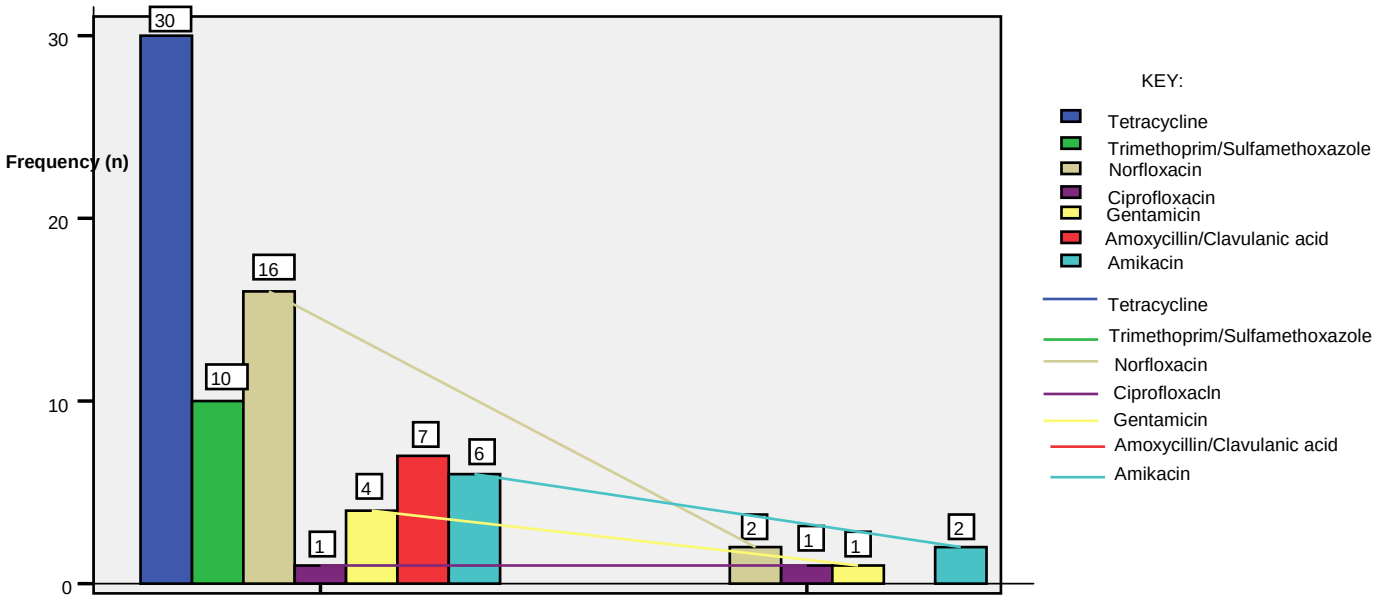

Figure 1. Frequency of unprescribed antibiotics sold at Veterinary pharmaceutics

DISCUSSION

This was a survey carried out to determine the Effects of antibiotic prescription practice in cattle on the development of antibiotic resistance of bacteria to both cattle and humans in Moshi, northern Tanzania. Antibiotic resistance is currently a global burden to both humans and animals. This is due to increasing dissemination in both human and animal populations. The study observed a higher correlation of unprescribed antibiotics used in cattle to the dissemination of antibiotic resistance in both cattle and human populations.

This study reported a list of unprescribed drugs named Tetracycline, Trimethoprim/sulfamethoxazole, and Amoxicillin/clavulanic acid in cattle from veterinary pharmaceutics that was highly solid (100.0%) and possibly pose resistant to most common bacteria reported in previous studies.2 The findings suggested that the lack of enough veterinary professionals resulted in starting treatments without laboratory testing results and initiating treatment based on symptoms or signs described by the owners.

Moreover, the study proposed that most cattle keepers preferred to use un-prescribed drugs to serve costs. They also started treatment before laboratory results using their experience on previous exposure to a disease presenting the same symptoms or signs on their cattle.

Antimicrobial resistance might also pose not only due to consumption of cattle products containing resistant isolates to most antibiotics but also possibly due to additional factors resulting in the development of antimicrobial resistance such as previous exposure to antibiotics (second or third-generation cephalosporin), nosocomial infections.2,11,20,22,23-27 Humans might have consumed a large quantity of food from animal products such as meat or milk contained some resistant strains of bacteria that might pass the resistant gene to pathogenic and commensally microbiota in humans. This predicts a cross-transmission of a resistance strain from cattle to humans resulting in antibiotic resistance.

The high use of un-prescribed drugs (trimethoprim/ sulfamethoxazole, amoxicillin/clavulanic acid, and tetracycline) which harmony with the recent findings that noted resistance to trimethoprim/ sulfamethoxazole and tetracycline.2 This might be due to using cattle products (milk or meat) before the withdrawal period as a result of ignorance on human effects.

We recommended other similar studies involving a wide range of sites and with prescription practice in human pharmacies (pharmaceutical shops) for profiling and correlating the level of drug resistance in both animals and humans. Moreover, there is a need to carry out a study to compare the genotypes of ESBL sequences of isolates and antibiotic residue in both animals and humans.

The nation is supposed to provide health education to animal keepers on the usefulness of prescribed drugs and the effects of using un-prescribed drugs in both humans and cattle to reduce spread and dissemination resistance to humans. The nation could design and promote special animal diagnostic laboratories to make a routine diagnosis of animal diseases before treatment like in human settings.

CONCLUSION

The regulation of Veterinary antibiotic prescription at veterinary pharmaceutical shops has to be a point of discussion and paid greater attention to control selection of antibiotic resistance both cattle and humans. The study is encouraging the 'ONE HEALTH' approach which will ensure reduction of dissemination and spread of antibiotic-resistant bacteria in both humans and cattle as suggested by the previous study.

ETHICAL APPROVAL

This study was ethically approved and granted by the Kilimanjaro Christian Medical University College Research Ethics and Review Committee (CRERC) with research ethical clearance number 669. Both human and animal components of this study were ethically approved by CRERC. The study participants including cattle owners provided written consent forms that contained all the information about the study before the specimen or data collection.

Author contributions

The author (R.S.M.) prepared a study, was involved in data collection, performed data analysis of as well as the developed manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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