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Research Article

Use of Human Antimicrobials in Veterinary Medicine, a Risk of Occurrence of Antimicrobial Resistance

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ABSTRACT

Goals: *In the absence of authorized veterinary medicinal products, veterinarians may use authorized human medicinal products if necessary. The number of registered veterinary drugs, including veterinary antibiotics, has increased over the years. It is increasingly important to reduce the use of medically important antimicrobials in veterinary medicine to prevent the development and spread of antimicrobial resistance. The aim of this study was to analyze trends in the use of human antibiotics in veterinary medicine in Lubumbashi.*

Methods: *Data on human antibiotics used in veterinary medicine were collected by a field survey among broiler breeders and in veterinary pharmacies. Data were recorded using a pre-established questionnaire on Google form. And we received 827 responses, and the results were analyzed on EPI Info 7.3.2.6*

Results: *Antimicrobials from all families are used either for treatment or for prevention or even as a growth booster. The sources of supply are mainly veterinary and human pharmacies, the dosages are in most cases veterinary, or an adaptation and the average duration of treatment is 5 days for diseases and throughout the breeding period as a booster or in prevention. Overall, the calculation of dosage, the interaction of food and water with which the antibiotics are mixed actively participate in the reduction of the concentration of antibiotics which is responsible for the occurrence of multi-resistant strains.*

Conclusions: *Although the number of registered veterinary antibiotics has increased over the years, the consumption of human antibiotics used in veterinary medicine has increased in total quantity and turnover. Control of the routes of administration, dosage and interactions of food and water for mixtures of antimicrobials is necessary.*

Introduction

Veterinary medicine is concerned with the care and well-being of animals and, indirectly, that of humans. It should be noted that the term "animals" is very generic, encompassing terrestrial, aquatic and avian species, which can be divided into production, companion animals and exotic/wild animals, all sharing different ecosystems with humans, either directly or indirectly. These animals have many diseases in common with humans, even infectious ones (e.g., bacterial, viral, parasitic), although different etiological agents usually cause them. Therefore, it is also common to share medications, including antibiotics. As highlighted in Regulation (EU) 2019/6[1]. the phenomenon of AMR in animals is much more complex than in humans and requires even more careful and conscious use of antibiotics [2] . Its impact on animals, as well as on humans and the environment, is enormous and only the veterinarian is the main reference here and has a great responsibility towards the man-animal-environment triad[3,4]. This sharing of such a burden with human medicine and cooperating towards the same goal of combating and containing AMR, represents an effective example of application of the One Heath approach[5].

However, despite the recognized importance of the One Heath approach and the responsible and prudent use of antibiotics, many aspects remain uncontrollable including interspecies differences in kinetics and dynamics are just one example among many examples. possible)[6]. The common use of classes of antibiotics, including those of high clinical value, in human and veterinary medicine, is a critical factor contributing to or suspected of promoting the emergence of antibiotic resistance [7,8]. Resistance to antimicrobials of animal origin, responsible for direct and/or indirect threats to human health[9]

This study aims to change prescribing behavior in order to guarantee the rational use of antibiotics and prevent the occurrence of antibiotic resistance, which already constitutes a serious public health problem throughout the world.

Methods

Design of the decor and study. This was an observational study carried out in the city of Lubumbashi carried out from January to April 2024 as field work for students from the Faculty of Medicine at the University of Lubumbashi. Poultry is one of the most widespread food industries in the world. Chicken is the most commonly farmed species, with more than 90 billion tonnes of chicken meat produced per year[10] which is why we chose to collect data in this sector. Indeed, a wide variety of antimicrobials are used to raise poultry in most countries [11]. Many of these antimicrobials are considered essential in human medicine [12, 13].

This study approached all doctors prescribing antibiotics according to their sectors of activity using a pre-established and pretexted questionnaire. Survey data were included using google form, imported using Microsoft Excel 365, and analyzed using IBM SPSS Statistics 28.0.1.0 (142).

Results

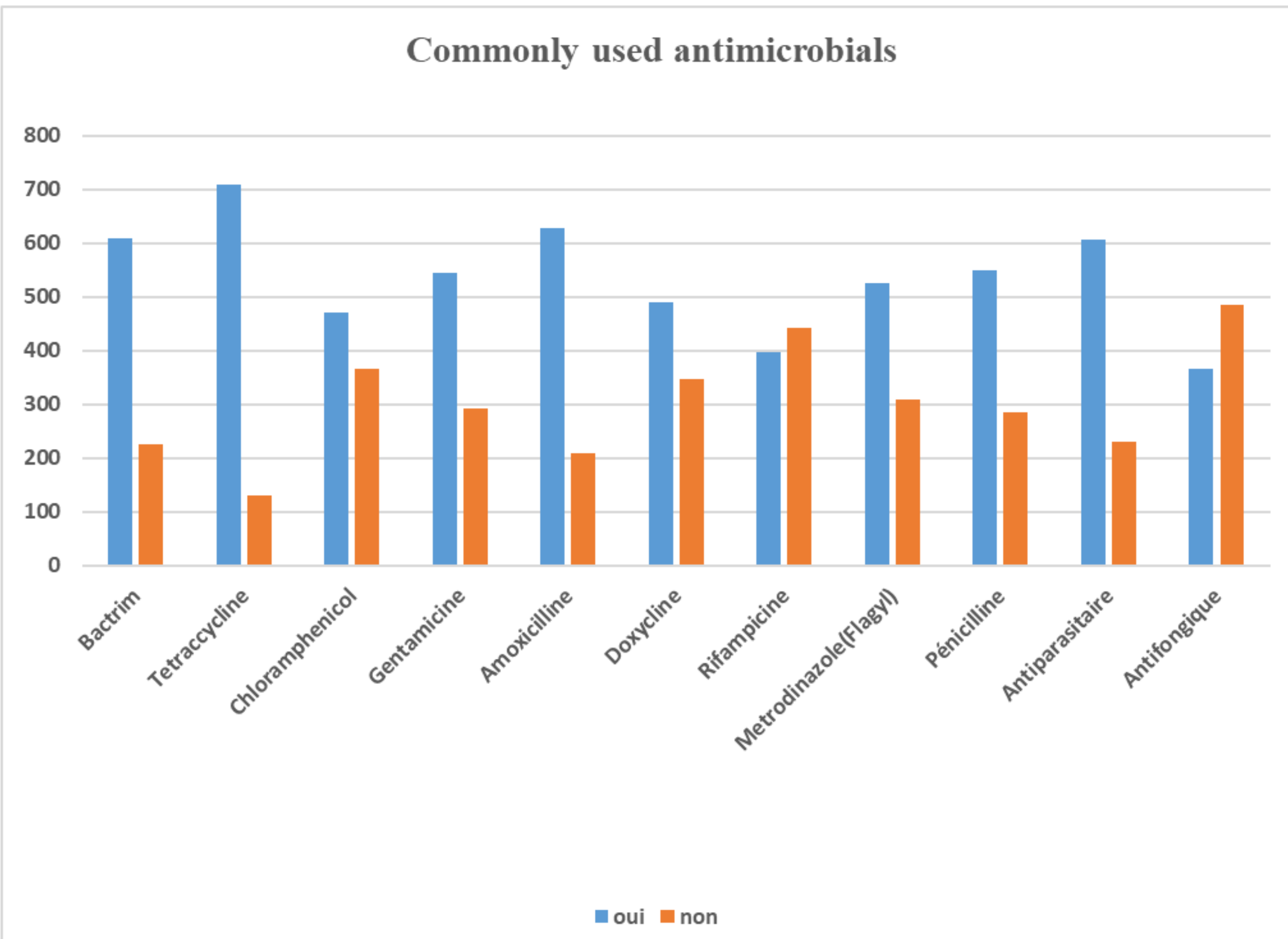

Figure 1: List of human antimicrobials used in veterinary medicine

This figure shows the list of human antimicrobials used in veterinary medicine, the most used of which are tetracycline, amoxicillin, Bactrim and antiparasitics.

The widespread use of antibiotics in livestock is one of the main causes of the emergence of antibiotic resistance [14]. The World Health Organization (WHO) has identified a list of antimicrobials considered to be of critical importance (including 3rd, 4th and 5th generation cephalosporins, glycopeptides, macrolides, polymyxins and quinolones) which should be avoided in animal production (World Health Organization, 2019)[15]

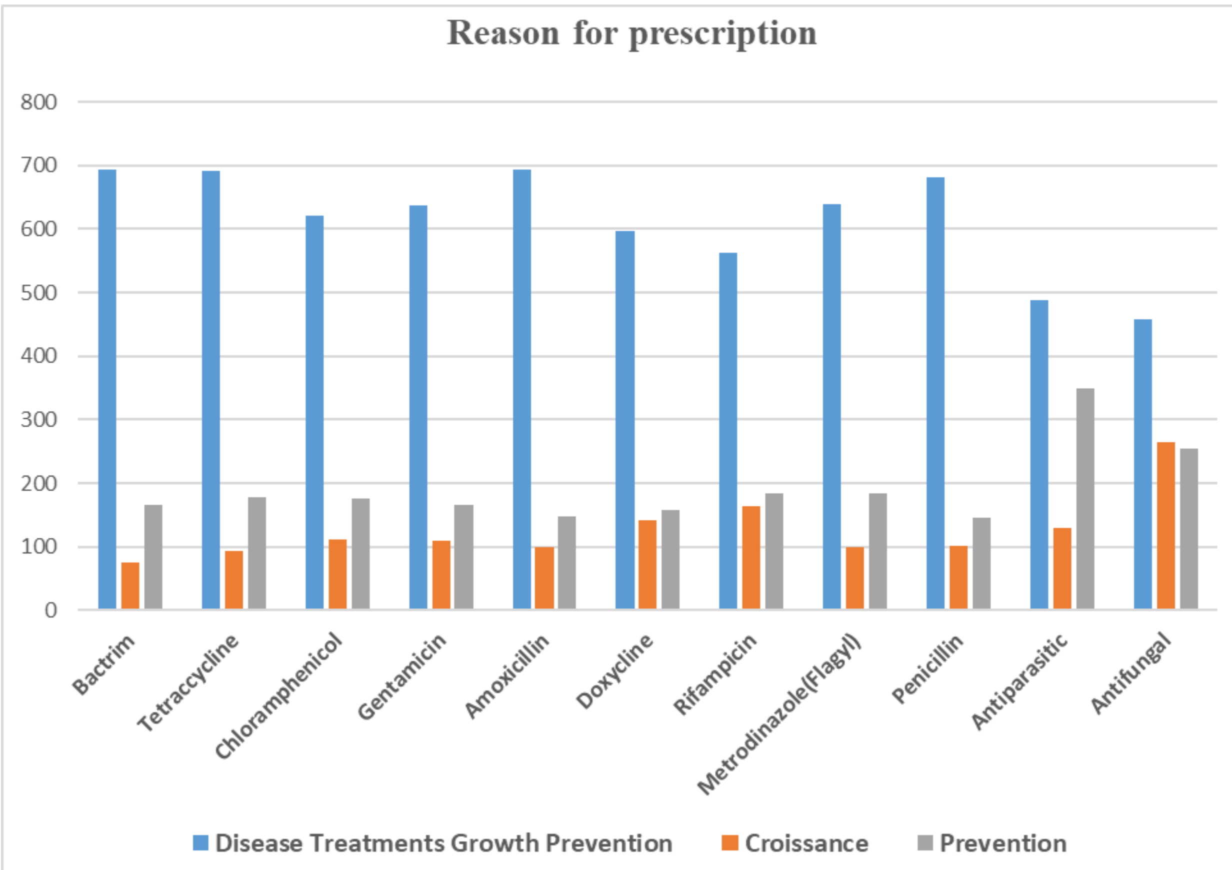

Figure 2: Reasons for prescription

The main reason for prescribing antibiotics is the treatment of diseases and as a growth booster and rarely

Diseases were a significant challenge among the poultry farmers surveyed due to the use of antibiotics. Controlling disease through measures such as biosecurity procedures and vaccination is key to reducing the use of antibiotics. This was demonstrated in pig farms in Belgium, where the level of biosecurity was associated with the quantity of antibiotics used [16]. Among poultry farmers, antibiotics are used variably: at subtherapeutic doses to improve production, particularly in layers and broilers. The application of antibiotics at subtherapeutic doses results in selection pressure stimulating the emergence of resistant bacteria

[17]. Similarly, studies in Vietnam and Cambodia found that antibiotics were widely used to protect day-old chicks from infections upon arrival.

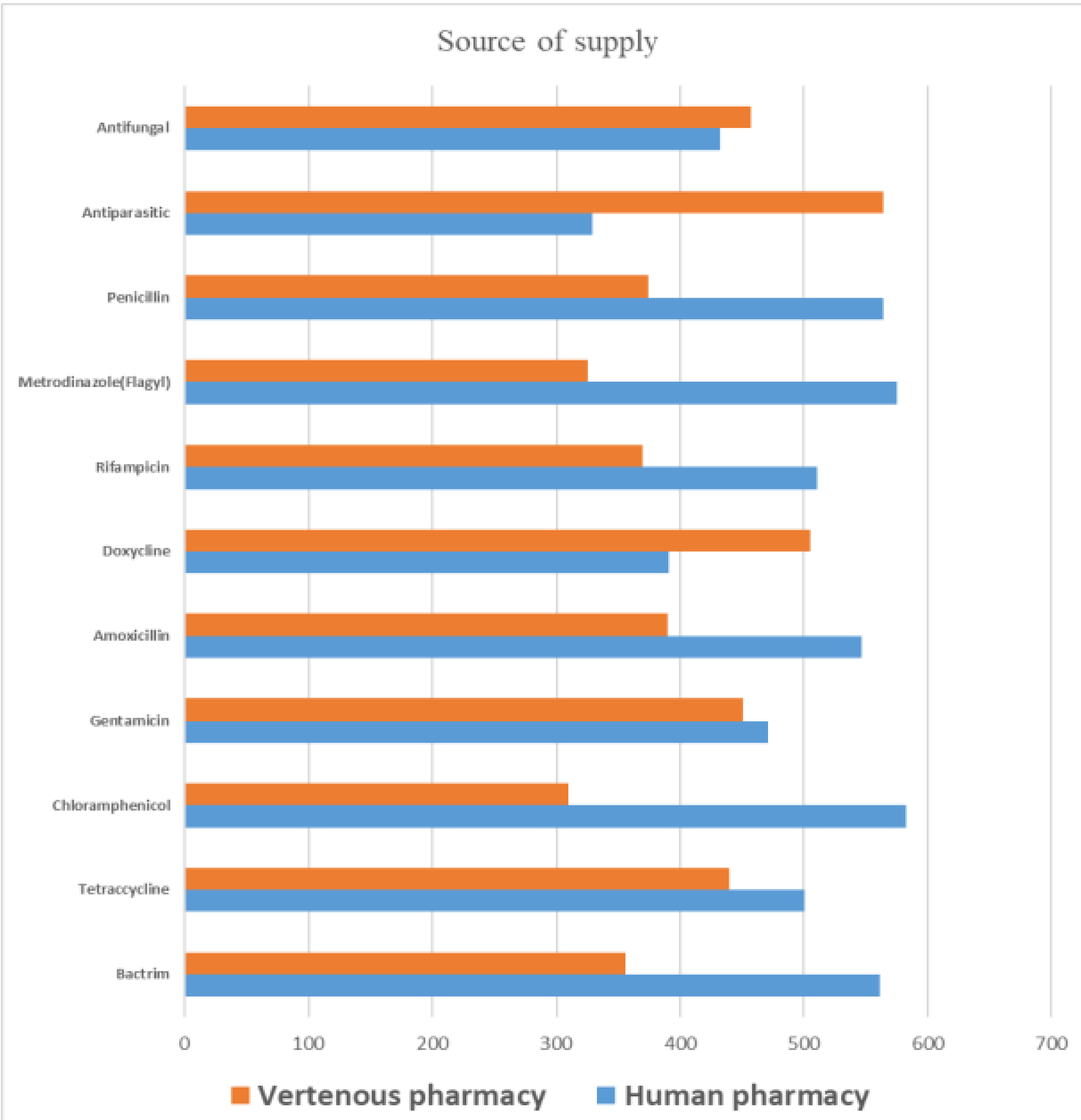

Figure 3 source of supply of antibiotics

The source of supply for antibiotics is human drug pharmacies and antiparasitics are supplied from veterinary pharmacies.

A high prevalence of antibiotic-resistant bacteria in poultry has also been reported [18, 19]. It appears that poultry farmers rarely seek the consultation services of a veterinarian, and that self-prescription of antibiotics is therefore widespread [19]. The most commonly used antimicrobials in livestock production among the rural population of northern Tanzania are tetracyclines, pencils, aminoglycosides, macrolides and sulfonamides.[20]

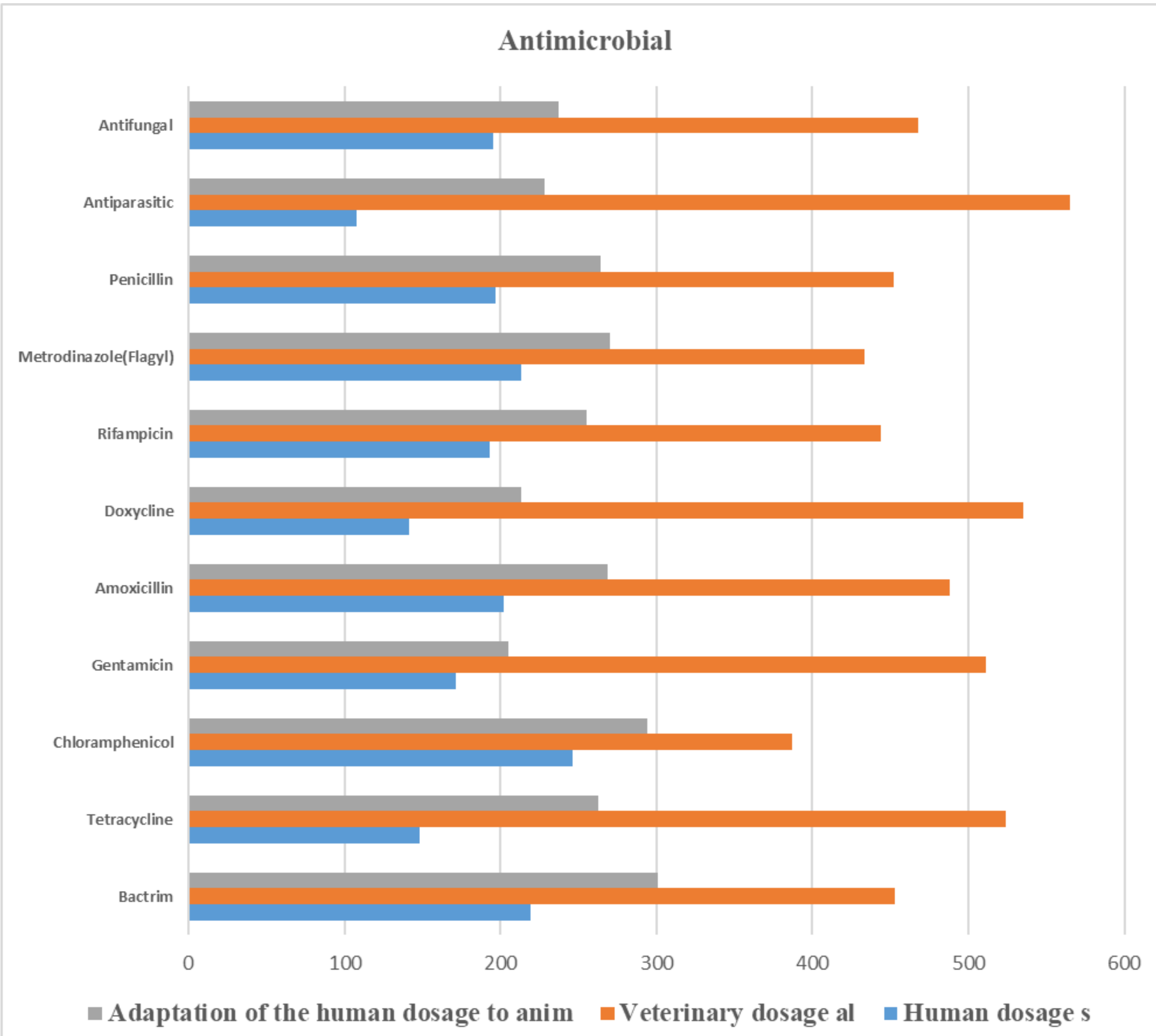

Figure 4: Antimicrobial dosage

The dosage according to veterinary standards is applied to antibiotics for humans mainly, some practices base adaptations of human dosage to animals

Most antibiotics used to treat infections in humans are also used in animals to enhance production or for the treatment of infections [21]. This creates an interdependence between human, animal and environmental health and a potential transfer of resistance.

AMR in livestock can lead to bacterial diseases that are difficult to treat due to the lack of effective treatment options, leading farmers to turn to more aggressive treatments or use antimicrobials considered critically important for the treatment of human diseases [22]. It appears that poultry farmers rarely seek AMR consultation services in livestock can lead to bacterial diseases that are difficult to treat due to the lack of effective treatment options, leading farmers to turn to treatments more aggressive or to use antimicrobials considered of crucial importance for the treatment of human diseases [23].

Resistant bacteria can be transferred from poultry products to humans via consumption or handling of pathogen-contaminated meat [24]. Once these pathogens are in the human system, they could colonize the intestines and the resistance genes could be shared or transferred to the endogenous intestinal flora, compromising future treatments of infections caused by such organisms[25;26].

Table 1: Distribution of Antibiotics and Poultry Diseases

	Diarrhea with white feint	**Diarrhea with green feint**	**Cough**	**Diarrhea with brown feint**	**Diarrhea with green and white feint**	**Diarrhea with greenish-yellow appearance**	**Diarrhea with black spots**	**Diarrhea with traces of blood**	**Diarrhea with yellow droppings**
Bactrim	245	100	524	63	47	46	37	52	51
Tetracycline	327	272	144	148	122	113	83	100	129
Chloramphenicol	259	252	177	127	103	115	103	109	110
Gentamicin	220	242	261	159	126	85	68	82	81
Amoxicillin	244	179	344	108	114	94	75	101	86
Doxycline	251	231	202	141	145	110	75	94	84
Rifampicin	168	161	271	94	80	77	99	94	73
Metronidazole(Flagyl)	279	214	83	149	138	114	106	179	166
Penicillin	254	183	224	120	105	90	94	115	122
oxytetracycline	247	222	188	158	146	157	146	140	166
pest control	279	205	139	129	116	102	123	182	211

The use of antibiotics according to the signs observed shows that Bactrim and amoxicillin are used for cough, tetracycline and chloramphenicol for white or green diarrhea, gentamicin and oxytetracyline for brown diarrhea, doxycline and oxytetracycline for green and white diarrhea, oxytetracycline in case of greenish-yellow and black diarrhea, and metronidazole and oxytetracycline for bloody and yellow diarrhea. Antiparasitics are more associated with white, green, yellow and bloody diarrhea.

In poultry, β-lactams were considered the first line of drugs for the treatment of staphylococcal infections, but due to the emergence of an important level of resistance to these and other drugs, there are currently very few drugs available for the treatment of these infections[27]. In Africa, studies in Ghana and Nigeria showed that livestock-related diseases, Staphylococci were susceptible to amoxicillin/clavulanic acid, amikacin, ciprofloxacin, gentamycin and cephalexin[28,29]. Pseudomonas spp infection is common in poultry such as chickens, turkeys, ducks, geese and ostriches, where infections in eggs destroy embryos[30]. P. aeruginosa causes respiratory infection, sinusitis, keratitis/keratoconjunctivitis and septicemia and is responsible for pyogenic infections, septicemia, endocarditis and lameness as well as many various diseases[31]. Pseudomonas isolated from infections in poultry are susceptible to levofloxacin in the range of 20 to 100% and almost 75% have demonstrated intermediate sensitivity to aztreonam. The organisms have shown resistance to cephalosporins, carbapenems, penicillins, quinolones, monobactam and aminoglycosides. [32]. And in Africa, a study conducted in Nigeria found that P. aeruginosa isolates were highly resistant to β-lactams, tetracycline, tobramycin, nitrofurantoin, and sulfamethoxazole-trimethoprim, while ofloxacin, imipenem, and ertapenem were highly effective against the agent's bacterial pathogens[33]

Certain strains of Escherichia coli are responsible for gastroenteritis[34] and tetracycline, commonly used in poultry, is considered one of the drugs to which the bacteria are the most resistant. Resistance to tetracycline has been reported in poultry even without the administration of this antibiotic.[35]

Pullorosis in poultry is caused by S. pullorum, Antimicrobials used to treat pullorosis are furazolidone, gentamycin sulfate, and antimetabolites (sulfadimethoxine, sulfamethazine, and sulfamerazine) [36] . C. jejuni and C. coli are the predominant species of Campylobacter usually isolated from poultry farms from local chicken feces and swabs. the organisms were found to be resistant to β-lactams, quinolones, aminoglycosides, erythromycin, tetracycline, chloramphenicol and trimethoprim-sulfamethoxazole and all isolated species were susceptible to imipenem[37]. C. perfringens from clinical cases of necrotic enteritis in broilers. More than 95% of isolates were resistant to sulfamethoxazole-trimethoprim, doxycycline, perfloxacin, colistin and neomycin. Most isolates were susceptible to amoxicillin, ampicillin, fosfomycin, florfenicol and cephradine [38].

Table 2: Distribution of Antibiotics and duration of treatment

	5 days	6-10 days	10-15 days	until symptoms disappear	throughout the breeding period
Bactrim	444	185	37	187	38
Tetracycline	389	201	60	208	41
Chloramphenicol	361	189	74	221	75
Gentamicin	375	222	67	195	42
Amoxicillin	400	194	70	182	53
Doxycline	353	205	79	189	62
Rifampicin	314	197	91	227	86
Metronidazole(Flagyl)	316	210	66	243	73
Penicillin	346	229	69	222	50
oxytetracycline	346	196	90	197	86
pest control	304	155	64	215	181

The treatment duration for most antimicrobials is 5 days and some range from 6 to 10 days. some use them until symptoms disappear. And when antibiotics are used as a booster, breeders use them throughout the breeding period. Diseases were a significant challenge among the poultry farmers surveyed due to the use of antibiotics.

In poultry antimicrobial stewardship, it is important to select drugs and dosing regimens that reflect the five rights: the right drug, the right time, the right dose, the right duration and the right route[39]. Oral administration is most effective for infections involving the digestive tract. Drinking water medications are generally more effective than feed medications because they can be started and changed more quickly, and because both poultry and sick birds can continue to drink even after they have stopped. to eat[40]. However, a number of drug-drug interactions (DDIs) have been described in poultry: Drug-herb interactions[41]; Hard water[42]; Microbial degradation[43]; Prandial status [44]; Water disinfectants[45,46]; In addition to these, there are factors influencing pharmacokinetics and clinical outcomes in poultry: Dose imprecision (the administration of drugs in water or food to populations of birds of varying weight and health makes it impossible to administer a predictable, precise and planned dose.)[47]; The age of birds which has an impact on pharmacokinetics[48]; circadian variation[49]; …all these factors adversely impact the bioavailability, pharmacokinetics of antibacterial agents used to treat infections in poultry. Because acting in the blood to reduce the concentration of antimicrobials by degradation or by transformation into a product.

Regarding the duration of treatment, it varies depending on the circumstances and epidemic characteristics. In the event of an acute disease outbreak, treatment should be continued until mortalities cease and clinical signs are no longer apparent in the herd[50,51]. Usually this takes at least 3 days, and mortality may continue to increase during the first few days as severely affected birds succumb, especially if they are too ill to take medication. However, acute illnesses are usually brought under control within 5–7 days, and if no response is apparent within 3–5 days, the diagnosis and treatment regimen should be reevaluated[52].

Conclusion

The choice of antimicrobial agents is based on a small form for the treatment of birds carrying pathogens whose antimicrobial resistance status is evolving.

Several bacterial species are the main causes of infections in poultry and other livestock. Most of these infections are linked to foodborne outbreaks, contact with live animals, poor hygiene, and environmental exposure. With the emergence of antimicrobial resistance, the pathogenicity and virulence of these organisms have increased, and treatment options are decreasing and also becoming more expensive. Multidrug-resistant bacteria are often found in poultry, poultry products, carcasses, bird litter and feces, posing a risk to both handlers and consumers, as well as a threat to health global and public.

The main reasons for the use of antibiotics in food animals include prevention of infections, treatment of infections, promotion of growth and improvement of production in farm animals. And indiscriminate use of these essential antimicrobials in animal production is likely to accelerate the development of antimicrobial resistance in pathogens as well as commensal organisms. This would lead to treatment failures, economic losses, and could serve as a gene pool source for transmission to humans. Additionally, there are also human health concerns regarding the presence of antimicrobial residues in meat, eggs, and other animal products.

Effective treatment of poultry with antimicrobial agents requires an understanding of the multitude of factors that influence selection of the appropriate drug, administration in a route and dosing schedule that increases the likelihood of adequate drug exposure of treated birds, and minimizing those factors that are associated with pharmacokinetic variability.

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