Int J Biol Med Res. 2024; 15(3): 7816-7820

Contents lists available at BioMedSciDirect Publications

International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com

Original article

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

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ARTICLEINFO

Keywords:
veterinary
Antimicrobials
human medicinal products
antimicrobial resistance

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 and moreover in 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.

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Introduction

The threat of antimicrobial resistance threatens the health of humans, animals, plants and our shared environment. Antimicrobials are misused or overused in all these different sectors, which creates ideal conditions for the acceleration of the emergence of resistance which is sometimes difficult to control.

From human medicine to agriculture, including veterinary medicine and animal breeding, antimicrobials are used on a large scale in violation of standards.

Veterinary medicine is concerned with the care and well-being of animals and, indirectly, that of humans; these animals are victims of diseases common to humans and as a result they share the same medications, notably antibiotics[1]. In animals, the AMR phenomenon is complex and requires optimal and rational management of antibiotics[2], otherwise, this phenomenon will have a significant impact on the man-animal-environment triad which calls for everyone's responsibility[3 ,4]. This situation calls for a collaboration of the two medicines in a One Health approach with the aim of fighting and preventing AMR [5].

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Unfortunately, despite the efforts of the One Heath approach on the optimal use of antibiotics, many aspects escape control [6].The current use of classes of antibiotics in human and veterinary medicine is a factor likely to favor the emergence of antibiotic resistance [7,8] and constitutes a direct and/or indirect threat 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

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 with a high production of meat per year estimated at more than 90 billion tonnes [10] which is why we chose to collect the 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] according to the World Health Organization (WHO), 3rd, 4th and 5th generation

cephalosporins , glycopeptides, macrolides, polymyxins and quinolones should be avoided in animal production[15] and yet in our series, we find that gentamicin, an antibiotic from the aminoglycoside or aminoglycoside family, was well used notwithstanding its presence on the prohibited list of the WHO list.

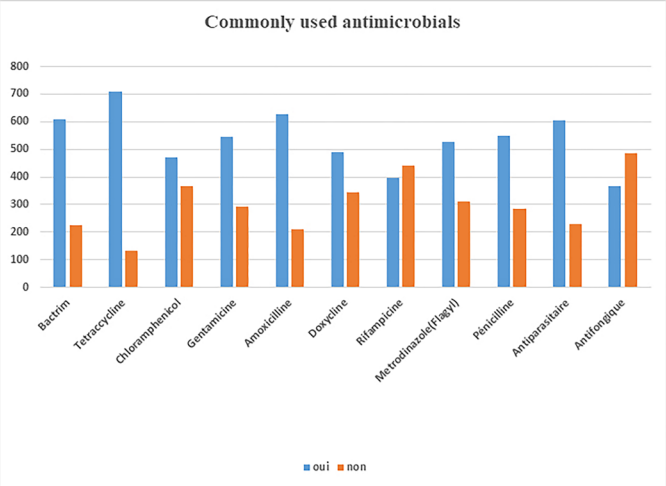
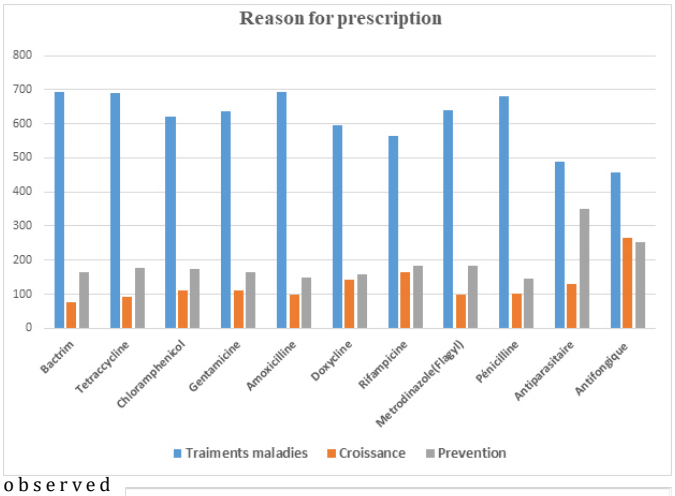


Figure 2: Reasons for prescription

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. However, the recommendations require thatthe fight against diseases must be done with a reduction in the use of antibiotics through the use of biosecurity procedures and vaccination [16].Usually, for poultry antibiotics are used at subtherapeutic doses to improve production which can lead to selection pressure stimulating the emergence of resistant bacteria [17].

Figure 3 source of supply of antibiotics

The source of supply for antibiotics is human drug pharmacies and antiparasitics are supplied from veterinary pharmacies. In view of the high prevalence of antibiotic-resistant bacteria in poultry [18 , 19]. It clearly appears that the purchase of antibiotics by breeders is rarely done after a consultation with a veterinarian, what is more, the self-prescription of antibiotics is the most



observed purchase world [19]. And this is for the end of animal production mainly. And, as in our study, tetracyclines, pencils, aminoglycosides, macrolides and sulfonamides are the most consumed [20].

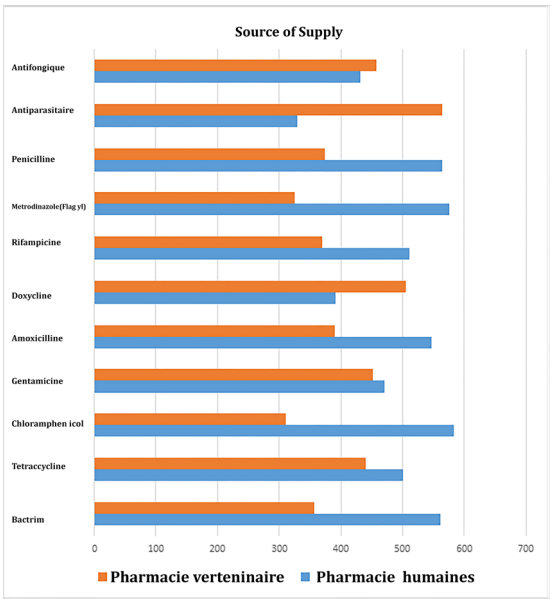


Table 1: Distribution of Antibiotics and Poultry Diseases

	Diarrhea with white feint	Diarrhea with green feint	Cough	Diarrhea with brown feint	Diarrhea with green and white feint	Diarrhea with green-ish-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
Chloram-phenicol	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
Metronida-zole(Flagyl)	279	214	83	149	138	114	106	179	166
Penicillin	254	183	224	120	105	90	94	115	122
oxytetracy-cline	247	222	188	158	146	157	146	140	166
pest control	279	205	139	129	116	102	123	182	211

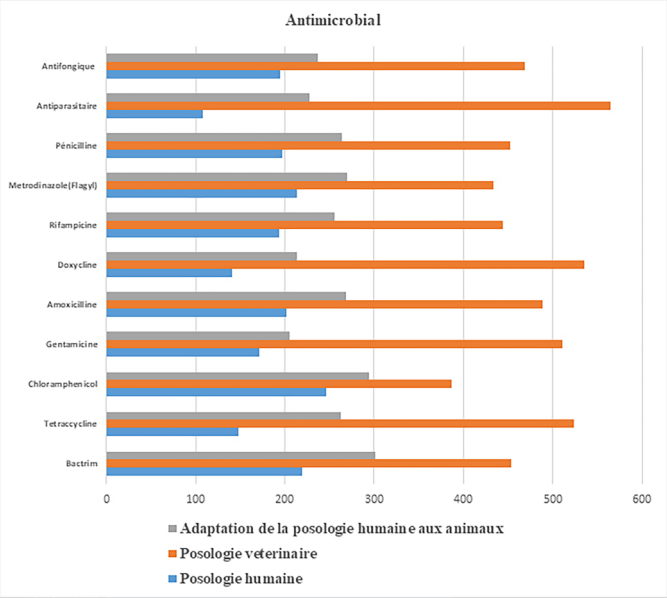


Figure 4: Antimicrobial dosage

The dosage according to veterinary standards is applied to antibiotics for humans mainly, some practices base adaptations of human dosage to animals. The dosage of antibiotics as in humans should depend on weight and the objectives of treatment. For poultry, antibiotics are used for therapeutic and non-therapeutic purposes Improved production being the main reason for the use of antibiotics in animals and even though most of the antibiotics used are also used in humans, [21]. Hence the interdependence between human health , animal and environmental and a potential transfer of resistance. Also, in the case of RAMS in animals, the lack of effective treatment options pushes farmers towards the use of antimicrobials reserved for the treatment of human diseases [22] by self-medication and in the absence of any consultation [23]. The transmission of resistant bacteria occurs through the consumption or handling of meat contaminated by pathogens [24]. Once in the human system, these pathogens would colonize the intestines with the possibility of transmitting resistance genes to bacteria from the endogenous intestinal flora [25;26]

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, formerly effective as first line against staphylococcal infections, but today very few drugs available for the treatment of these infections due to the emergence of a high level of resistance [27]. This presages the use of other alternatives, in particular what studies carried out in Ghana and Nigeria showed that Staphylococci isolated from livestock-related diseases were sensitive to amoxicillin/clavulanic acid, amikacin, ciprofloxacin, gentamycin and cephalexin[28,29]. And in poultry, the germs most commonly responsible for infections include Pseudomonas spp which infect eggs and destroy embryos[30], are also responsible for respiratory infections, sinusitis, keratitis/kerato-conjunctivitis, septicemia and endocarditis as well as many various diseases[31]; and has a sensitivity to levofloxacin in the range of 20 to 100%, almost 75% for an intermediate sensitivity to aztreonam and resistance to cephalosporins, carbapenems, penicillins, quinolones, monobactam and aminoglycosides.[32] . Strains of Pseudomonas spp isolated in Africa from Nigeria were very resistant to β-lactams, tetracycline, tobramycin, nitrofurantoin and sulfamethoxazole-trimethoprim[33]Tetracycline in our series is used during diarrhea with white and green droppings, while in poultry, tetracycline is considered one of the drugs to which bacteria are the most resistant[35].

Pullorosis in poultry is caused by S. pullorum and manifests itself as green diarrhea in the hen and yellow in the chicks, as well as great thirst and reduced egg laying . In our series, tetracycline and chloramphenicol are used for diarrhea with green stools and oxytetracycline for those with yellow stools and yet the literature indicates that the antimicrobials used to treat pullorosis are furazolidone, gentamycin sulfate and antimetabolites (sulfadimethoxine, sulfamethazine and sulfamerazine)[36]. C. jejuni and C. coli, generally isolated from poultry farms whose digestive tract constitutes a major reservoir of the bacteria, are resistant to β-lactams, quinolones, aminoglycosides, erythromycin, tetracycline, chloramphenicol and trimethoprim-sulfamethoxazole and all isolated species were sensitive to imipenem[37]. C. perfringens, the etiological agent of necrotic enteritis in broiler chickens observable by the damage to intestinal cells, promotes vulnerability to clostridia, because the bacteria find optimal conditions there. This results in “black diarrhea” (necrotic enteritis) accompanied by a drop in weight as well as an increase in losses, in our series these cases were preferentially treated by administration of oxytetracycline followed by metronidazole (as in humans) while in recent studies, Clostridium perfingens presents resistance to sulfamethoxazole-trimethoprim, doxycycline, perfloxacin, colistin and neomycin and sensitivity 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 management requires respect for 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, especially if mixed with drinking water or food [40]. However, it is important to avoid drug-herb interactions in poultry[41];water hardness[42];microbial degradation[43];prandial status [44];the presence of water disinfectants[45,46]; and pharmacokinetics as well as dose inaccuracies due to dilution either in water or in food as well as due to weight variations between poultry of the same litter [47]; The Age of Birds [48]; circadian variation[49];...all these factors have an adverse impact on the bioavailability 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 out-

break, 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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