IJMPR 2020, 4(2), 01-06

International Journal of Modern Pharmaceutical Research
www.ijmpronline.com

ISSN: 2319-5878
IJMPR
Review Article

SJIF Impact Factor: 5.273

ANTIMICROBIAL USE IN LIVESTOCK AND AGRICULTURE: EXPLORING THE CONSEQUENTIAL RESISTANCE

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Received on: 10/02/2020
Revised on: 01/03/2020
Accepted on: 20//03/2020

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ABSTRACT

The use of antimicrobial compounds in the production of animal feed has demonstrated benefits, including better animal health, greater production and, in some cases, reduction of foodborne pathogens. However, the use of antibiotics for agricultural fins, in particular to stimulate growth, was closely monitored, as it demonstrates a contribution to the increased prevalence of bacterial antibiotics resistant to human importance. The transfer of antibiotic resistance genes and the selection of resistant bacteria can be done by different mechanisms, which are not always linked to the use of applicable antibiotics. Prevalence data can provide insight into the occurrence and changes in resistance over time; however, the reasons are diverse and complex. This issue has been widely discussed in the past nationally and internationally, and several adopted countries are either considering stricter restrictions or prohibitions on certain types of use of antibiotics in the production of animals for food. In some cases, the ban on the use of growth-promoting antibiotics appears to result in a decrease in the prevalence of certain drug-resistant bacteria; however, subsequent objects in animal morbidity and mortality, particularly in young animals, sometimes result in increased use of therapeutic antibiotics, which generally occur in families of drugs more relevant to human medicine.

KEYWORDS: Anti-microbials, livestock, antimicrobial resistance.

INTRODUCTION

Looking back on the history of human disease, infectious diseases represented a very large proportion of diseases as a whole.[1] It was not until the second half of the nineteenth century that microorganisms were responsible for a variety of infectious diseases that had plagued mankind since ancient times. In this sense, chemotherapy directed to the causative organisms was developed as the main therapeutic strategy. In 1935, sulfonamides were developed by Domagk and other researchers.[1] These drugs were synthetic compounds and had limitations in terms of safety and effectiveness. In 1928, Fleming discovered penicillin. He found that growth of Staphylococcus aureus was inhibited in a zone around a Blue mold (a fungus of the genus Penicillium) in culture plates, leading to the conclusion that a microorganism would produce substances that could inhibit the growth of other microorganisms. The antibiotic received the name of penicillin and came into clinical use in the 1940s.[2] Penicillin, which is an excellent agent in terms of safety and effectiveness, led the era of antimicrobial chemotherapy, saving the lives of many wounded welds during World War IIWorldwide.[3]

Antimicrobial drugs have caused a dramatic change not only in the treatment of infectious diseases, but also in the fate of humanity. Antimicrobial chemotherapy has made remarkable strides, resulting in the overly optimistic view that infectious diseases would be conquered in the near future. However, in reality, emerging and reemerging infectious diseases have left us with a counter load of infections. Infections with drug-resistant organisms remain a major problem in clinical practice, difficult to resolve. Antimicrobials are used in animals to treat or prevent disease and also to promote growth. Various sources provide data on these animal antimicrobial uses, including dosing schedules, contraindications and withdrawal times.

However, as early as the following year, 1961, methicillin-resistant S.aureus (MRSA) was isolated in the United Kingdom.[5]

If an inappropriate antimicrobial agent is chosen to treat infection by drug- resistant microorganisms. In addition, in a situation where multi-resistant organisms have spread widely, there may be a very limited choice of agents for antimicrobial therapy. Fewer new antimicrobial agents are currently entering the market. Considering this situation, together with the growing awareness of drug safety, we are now facing a situation of severely limited options among antimicrobial agents. This article provides an outline of the history of antimicrobial agents and later describes the resistant organisms that emerged in response to antimicrobial agents and discusses practical clues to avoid resistant microorganisms. Since around 1990, hospital infection with MRSA has become a social problem. During that time, the target of new antimicrobial agents, including second- and third-generation cephems, shifted from Gram-positive to Gram- negative bacteria, were widely used. MRSA acquires resistance to most lactam- based antibiotics through the acquisition of the 2 'penicillin-binding protein (PBP) gene; PBP2 'is an enzyme involved in cell wall synthesis that has low affinity for antibiotic-lactam binding.[6] In Japan, there have been no reports of VRSA strains so far, partially by less due to lower rates of VRE detection than in Western countries.[7]

The Origin of Anti Microbial Resistance

In its global report on AMR surveillance, The World Health Organization (WHO) stated that RAM in a wide range of infectious agents has become a serious audience health problem and a post- antibiotic era is a real possibility for the 21st century.[19] Although there were significant gaps in surveillance and lack of standards for methodology in many countries around the world, WHO reported very high rates of resistance to both community-based (HCA) and associated health care (CA) infections. Data indicated that resistance to fluoroquinolone in E. coli has been reported in 92 member states from 194 and 5 of 6 WHO global regions.[20,21] Similarly, resistance to third generation cephalosporins (probably due to a cephalosporinase) was recorded in 86 member states and 5 regions. Comparable numbers were observed for third generation cephalosporin or carbapenem resistance in K. pneumoniae and methicillin resistance in S. aureus.[22,23]

Other large epidemiological surveillance networks, including those in Europe, for example, the European Antimicrobial Resistance Surveillance Network - EARS - Network and Central East Asian Antimicrobial Resistance Surveillance (CAESAR) and in the United States (National Health Safety Network-NHSN at CDC) have also documented that antibiotic resistant bacteria have become much more prevalent over the past decade. The details of your data will be summarized below for different types of bacteria that can cause bacteremia in different healthcare settings.[24] An online tool is also available which shows current resistance rates and the use of antibiotics in several countries on an interactive map and the data is updated as new information becomes available.

Antibiotic Use in Live Stock Animal

Effective. Antibiotic prophylaxis should not be used as a substitute for optimal sterile technique. Antimicrobials should only be prescribed or administered when the veterinarian confirms that the bacterial disease is present or can reasonably be suspected based on the animal's clinical signs. Antimicrobials should only be used in food- producing animals when their use improves animal health and welfare. Veterinarians should avoid, as far as possible, the use of antimicrobials deemed important by ASTAG for human health in food-producing animals. Optimal susceptibility testing should be done to ensure that an antimicrobial with a high rating is the only option for effective treatment. Antimicrobials used as aqueous food or additives to target gastrointestinal microorganisms should, as far as possible, be selected based on their membership in a class of antimicrobials not used in humans and should be prescribed accordingly. based on recognized use of best practices.[42]

Registered antimicrobials are subject to rigorous peer review before being approved. Antimicrobials should only be used off the label (for a different species or indication, with a changed dose rate or treatment interval) when there is no alternative, no veterinary medicinal product recorded available and only when state law permits such use. The veterinarian should provide the client with written advice on retention periods and export slaughter intervals, as the veterinarian can be held responsible for any residue violation if they occur. Preferably, the use of very important off-label antimicrobials in individual members of food-producing animal.

Antimicrobials can be used prophylactically in groups of animals at high risk of bacterial infection, during chemotherapy, in severely immunocompromised patients, in appropriate surgical cases and in penetrating wounds in which decontamination or disinfection is not fully species should be limited to individuals who are not intended to enter the food chain.[41]

Recognizing the importance of antimicrobial resistance and the need for veterinarians to assist in efforts to maintain the usefulness of antimicrobial drugs in animals and humans, the Board of Regents of the American College of Veterinary Internal Medicines commissioned a special committee with the responsibility of writing this statement position on antimicrobials. use of drugs in veterinary medicine. Veterinarians also have an obligation to actively promote disease prevention efforts, to treat as conservatively as possible and to explain the potential consequences associated with antimicrobial treatment for animal owners and managers, including the possibility of promoting the selection of resistant bacteria. However, the consequences of losing the usefulness of an antimicrobial drug used as a last resort in humans or animals with resistant bacterial infections may be unacceptable from the point of view of public health orpopulation.

The Committee recommends that voluntary actions be taken by the veterinary profession to promote the conservative use of antimicrobials to minimize possible adverse effects on animal or human health. The veterinary profession should work to educate all veterinarians on issues related to the use of conservative antimicrobial drugs and antimicrobial resistance, so that each individual is better able to balance ethical obligations in relation to the perceived benefit to their patients versus the perceived health risk public. Specific means by which the veterinary profession can promote the administration of this valuable resource are presented and discussed in this document.[43] Antimicrobial drugs are used in animals, humans, and plants to treat and prevent bacterial infections.

These drugs are among the most important tools available to modern medicine. Few developments had such a drastic effect on human and veterinary medicine during the previous century as the development of antimicrobial drugs and their use in the prevention and treatment of bacterial diseases. However, shortly after the availability of antimicrobial drugs for use in human and veterinary medicine, it was recognized that reduced bacterial susceptibility can adversely affect the clinical outcome. Currently, it is widely recognized that susceptibility to these drugs is not universal among all bacterial species, nor is it the same among different strains of the same bacterial species. Resistance mechanisms can be intrinsic or acquired through a variety of genetic means. The variability in susceptibility to different antimicrobial drugs has become an important factor affecting the success of treating bacterial diseases. It is also common but incorrectly assumed that only target bacteria are exposed to antimicrobial drugs when the host is treated. Most, if not all commensal and transient microbial flowers, are exposed to varying amounts of antimicrobial treatment during the drug. Although resistance in these bacteria called “stand- by-stander” may have no consequences in one host species, these organisms can cause disease in other hosts, 618 Morley et aland all resistant bacteria can serve as reservoirs of resistance genes. antimicrobial resistance affects the health of humans and animals. There are concerns that the emerging resistance among bacteria, if left aside, may increase to the point that the effectiveness of many of the most important drugs will no longer be predictable and some bacterial infections will once again be untreatable. Although a considerable debate involves this issue, research is required to further document the risks to humans and animals posed by antimicrobial resistance, because scientifically sound information is essentially unavailable.[43,44]

Anti Microbial Resistance

The use of antimicrobials in animals may contribute to the development and dissemination of bacterial resistance. The increasing frequency of ADR is a global health problem and poses significant risks to human and animal health and well-being. The veterinary profession accepts the responsibility of working with human health professions to reduce the likelihood of ADR in order to preserve their effectiveness. critical medications.[34]

Antimicrobial resistance in animal pathogens can cause therapeutic failures with subsequent adverse effects on animal health, welfare and productivity, also as adverse economic and social effects to their owners. Antimicrobial resistance can also be transferred between human bacteria. and animals via the food chain, through direct contact between them and through environmental exposure.[33]

The use of antimicrobials in the food chain has been shown to contribute to increasing levels of resistance in food-borne bacteria (eg E. coli, Campylobacter jejuni, Salmonella spp. And enterococci).

Direct contact with treated animals can facilitate the transfer of resistant bacteria.2,4,5 Veterinarians, farm workers and pet owners treated with antimicrobials and those who deal with animal products such as carcasses, meat and offal, they must pay attention to hygiene during and after handling treated animals or their products.

AMR in man

According to the 'report on the scope of antimicrobial resistance in India (2017), under the auspices of the Government of India, among Gram-negative bacteria, more than 70% of Escherichia isolates are coli, Klebsiella pneumoniae and Acinetobacter. Baumann and almost half of all Pseudomonas aeruginosa were resistant to third generation fluoroquinolones and cephalosporins. Although resistance to the drug combination of piperacillin- tazobactum was still mutations in the gene (s) frequently associated with mechanism of action of the compound; acquisition of foreign DNA that encodes determinants of resistance by horizontal gene transfer (HGT).

Thus, the One Health approach is useful when it comes to treating zoonotic transmission of antimicrobial resistant pathogens, because we need to involve a wide range of stakeholders, including farmers, veterinarians, food safety professionals, doctors, doctors, environment and life experts in monitoring and control activities.[39]

Consequences of Antibiotic Resistance

Antibiotic resistance poses great threat to food safety and public health when the resistant bacteria spread from food animals to humans through the organic phenomenon. Antibiotics used in the first line treatment are no longer effective to eradicate common food-borne disease-causing bacteria such as Salmonella and Campylobacter.[38]

Mechanisms of Resistance Development

Bacteria can be resistant to the action of antimicrobial drugs because of the structure or physiology inherent in the bacteria (constitutive resistance), or they can develop mechanisms to circumvent the action of the drugs through genetic mutation or through the acquisition of genetic elements (required resistance). Genetic mutation is an abnormal process that occurs during bacterial replication and occurs spontaneously in DNA replication at a rate of 1 mutation per million bases per cell division.6 Due to the large number of bacteria produced during replication and the short interval generation, mutation is a common event. Although most mutations are probably harmful to the organism, by chance, a mutation can develop that gives selective advantage to bacteria exposed to antimicrobial drugs, which favors the survival of strains susceptible to the antimicrobial drug.

Resistance arises through one among three mechanisms: natural resistance to certain sorts of bacteria, mutation or one species acquiring resistance from another. All classes of microbes can develop resistance. Fungi develop antifungal resistance. Viruses develop antiviral resistance. Protozoa develop antiprotozoal resistance and bacteria develop resistance to antibiotics. Resistance can appear spontaneously because of random mutations. However, the prolonged use of antimicrobials appears to encourage the selection of mutations that can render antimicrobials ineffective.[11] in the work of health authorities.38 consistent with a review by Kelesidis and Falagas, India was the leading country within the manufacture and use of substandard and counterfeit antimicrobial agents, where up to 39% of the tested agents were found to be substandard. Approximately half the antibiotic consumed is eliminated unchanged from the body through feces and urine. The practice of defecating outdoors, as prevailing in India for many years, causes antibiotics or their residues to infiltrate the environment through soil and water. With almost 35% of the population being exposed to beverage contaminated with faeces, this a part of the environment contributes significantly to the event of RAM.[39]

Resistant bacteria are often introduced into the environment in several ways, such as the application of livestock manure as fertilizer. Another important source of resistant bacteria that end up in the environment is the rapidly growing aquaculture sector worldwide, characterized by intensive use of antimicrobials.

Our understanding of the epidemiology of AMR in animal production is further hampered by the dearth of comprehensive data on the use of antimicrobials (AMU) in the majority of countries. In addition, the development and spread of AMR is driven by human behavior, from prescribing antimicrobials to preventing and controlling infections. Understanding these factors can be an important step towards tackling AMR. Understanding the attitude and knowledge of farmers, veterinarians and pharmacists towards AMU and AMR can therefore be a crucial step in planning strategies to combat this threat to public health.

SUMMARY AND CONCLUSION

An antimicrobial is any naturally occurring, semi-synthetic or synthetic substance that kills or inhibits the growth of microorganisms, when we hope to cause minimal damage to the host. Antimicrobials are often used as therapy for bacteria (antibacterials), viruses (antivirals), fungi (antifungals) or protozoa (antiprotozoa). However, the term antibiotic refers to antimicrobials produced by another living microorganism.

Antimicrobials are often used therapeutically in animals to treat infectious diseases, but they will even be used for non-therapeutic purposes, such as growth promotion, prophylaxis and metaphylaxis. Antimicrobials represent one of the medical revolutions of humanity allowing us to treat human and veterinary bacterial infections. It is therefore of the utmost importance to preserve their effectiveness. However, in recent decades, the rapid and continuous development of antimicrobial resistance (AMR) has become a serious global public health problem.

Resistance to these substances can significantly limit treatment options for serious human bacterial diseases.

BIBLIOGRAPHY AND WEBOGRAPHY

1. Hashimoto H. Why Antimicrobial Agents Become Ineffective: Disease- causing Bacteria Are Evolving. Tokyo: Chuokoron Shinsha, Inc., 2000; 126-132.
2. Powers JH. Antimicrobial drug development—the past, the present, and the future. Clin Microbiol Infect, 2004; 10(Suppl 4): 23–31.
3. Jevons MP. “Celbenin”-resistant Staphylococci. Br Med J., 1961; 1: 124– 125.
4. Yamamoto T, Okubo T, Takano T, et al. Recent topics in emerging and re- emerging infectious diseases. J Jpn Soc Int Med, 2007; 96(3): 584–595.
5. Appelbaum PC. The emergence of vancomycin-intermediate and vancomycin- resistant Staphylococcus aureus. Clin Microbiol Infect, 2006; 12(Suppl 1): 16–23.
6. Yoneda N, Fujimoto Y, Uno M, et al. Annual changes in drug sensitivity of gonococci derived from urethritis in men. Jpn JChemother, 2004; 52(1): 31–34.
7. Fishman N. Antimicrobial stewardship. Am J Med. 2006; 119(6 Suppl 1): S53–S61.
8. WHO. Antimicrobial resistance. Bull World Health Organ, 2014; 61: 383–94.
9. De Kraker MEA, Davey PG, Grundmann H. Mortality and hospital stay associated with resistant Staphylococcus aureus and Escherichia coli bacteremia: estimating the burden of antibiotic resistance in Europe. PLoS Med, 2011; 8: e1001104.
10. FAO. The FAO Action Plan on Antimicrobial Resistance. Rome: Food and Agriculture Organization of the United Nations, 2016; 3–25.
11. Chang Q, Wang W, Regev-Yochay G, Lipsitch M, Hanage WP. Antibiotics in agriculture and the risk to human health: how worried should we be? Evol Appl, 2015; 8: 240–7.
12. Guardabassi L. Sixty years of antimicrobial use in animals: what is next? Vet Rec, 2013; 173: 599–603.
13. Ogro dowczyk, M.; Dettlaff, K.; Jelinska, A. "Beta-blockers: Currentstate of knowledge and perspectives". *Mini Reviews in Medicinal Chemistry*, 2016; 16(1): 4054.
14. *Spratto, G.R.; Woods, A.L. Delmar Nurse's Drug*

Handbook. Cengage Learning. ISBN 978-1-4390-5616-5, 2010.
15. Grant, R.L.; Combs, A.B.; Acosta, D. "Experimental Models for the Investigation of Toxicological Mechanisms". In McQ ueen, C.A. *Comprehensive Toxicology* (2nd ed.). Oxford: Elsevier, 2010; 204. ISBN 978-0-08-046884-6.
16. Cushnie, T.P.; O'Driscoll, N.H.; Lamb, A.J. "Morphological and ultrastructural changes in bacterial cells as an indicator of antibacterial mechanism of action". *Cellular and Molecular Life Sciences*, 2016; 73(23): 4471–4492.
17. Chang, C.C.; Slavin, M.A.; Chen, S.C. "New developments and directions in the clinical application of theechinocandins". *Archives of Toxicology*, 2017; 91(4): 1613–1621.
18. No authors listed "Mechanism matters". *Nature Medicine*, 2010; 16(4): 347.
19. Centers for Disease Control and Prevention (CDC). Antibiotic resistance threats in the United States, 2013.
20. O"Neill J (chair). Review on antimicrobial resistance: Tackling a crisis for the health and wealth of nations, 2014.
21. Teillant A, Gandra S, Barter D, Morgan DJ, Laxminarayan R. Potential burden of antibiotic resistance on surgery and cancer chemotherapy antibiotic prophylaxis in the USA: a literature review and modelling study. Lancet Infect Dis, 2015; 15: 1429-37.
22. Rice LB. Federal funding for the study of antimicrobial resistance in nosocomial pathogens: no ESKAPE. J Infect Dis., 2008; 197: 1079-81.
23. European Centre for Disease Prevention and Control (ECDC). Annual epidemiological report. Antimicrobial resistance and healthcare, 2014.
24. Jarlier V, Trystram D, Brun-Buisson C, Fournier S, Carbonne A, Marty L, Andremont A, Arlet G, Buu-Hoi A, Carlet J, et al. Curbing methicillin resistant Staphylococcus aureus in 38 French hospitals through a 15-year institutional control program. Arch Intern Med, 2010; 170: 552-9.
25. Grim SA, Rapp RP, Martin CA, Evans ME. Trimethoprim- sulfamethoxazole as a viable treatment option for infections caused by methicillin-resistant Staphylococcus aureus. Pharmacotherapy, 2005; 25: 253-64.
26. Roca I, Akova M, Baquero F, Carlet J, Cavaleri M, Coenen S, Cohen J, Findlay D, Gyssens I, Heure OE, et al. The global threat of antimicrobial resistance: science for intervention. New Microbes New Infect, 2015; 6: 22-9.
27. Wellington EM, Boxall AB, Cross P, Feil EJ, Gaze WH, Hawkey PM, et al. The role of the natural environment in the emergence of antibiotic resistance in Gram-negative bacteria. Lancet Infect Dis, 2013; 13: 155–65.
28. Van Boeckel TP, Gandra S, Ashok A, Caudron Q, Grenfell BT, Levin SA, Laxminarayan R. Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. Lancet Infect Dis., 2014; 14: 742-50.
29. Versporten A et al. WHO/Europe-ESAC Project Group. Antibiotic use in eastern Europe: a cross national database study in coordination with the WHO Regional Office for Europe. Lancet Infect Dis., 2014; 14: 381-7.
30. Hansen S, Zingg W, Ahmad R, Kyratsis Y, Behnke M, Schwab F, Pittet D, Gastmeier P; PROHIBIT study group. Organization of infection control in European hospitals. J Hosp Infect, 2015; 91: 338-45.
31. Bruce J, MacKenzie FM, Cookson B, Mollison J, van der Meer JW, Krcmery V, Gould IM; ARPAC Steering Group. Antibiotic stewardship and consumption: findings from a pan-European hospital study. J Antimicrob Chemother, 2009; 64: 853-60.
32. Jean SS, Lee WS, Yu KW, Liao CH, Hsu CW, Chang FY, Ko WC, Chen RJ, Wu JJ, Chen YH, et al. Rates of susceptibility of carbapenems, ceftobiprole, and colistin against clinically important bacteria collected from intensive care units in 2007: Results from the Surveillance of Multicenter Antimicrobial Resistance in Taiwan (SMART). J Microbiol Immunol Infect. Jan 10. pii: S1684: 1182(15)00021-3, 2015.
33. Cox G, Wright GD. Intrinsic antibiotic resistance: mechanisms, origins, challenges and solutions. Int J Med Microbiol, 2013; 303: 287–92.
34. Singer AC, Shaw H, Rhodes V, Hart A. Review of antimicrobial resistance in the environment and its relevance to environmental regulators. Front Microbiol, 2016; 7: 1728.
35. EMA. Revised ESVAC Reflection Paper on Collecting Data on Consumption of Antimicrobial Agents per Animal Species, on Technical Units of Measurement and Indicators for Reporting Consumption of Antimicrobial Agents in Animals. London: European Medicines Agency, 2013; 44: 1–29.
36. EMA. ESVAC: vision, strategy and objectives 2016-2020. European Surveillance of Veterinary Antimicrobial Consumption. London: European Medicines Agency, 2016; 44.
37. Jensen VF, de Knegt LV, Andersen VD, Wingstrand A. Temporal relationship between decrease in antimicrobial prescription for Danish pigs and the "Yellow Card" legal intervention directed at reduction of antimicrobial use. Prev Vet Med, 2014. 117: 554–64.
38. Antibiotic Use inFoodAnimals: India Overview. Published by: ReAct Asia-Pacific Christian Medical College, Vellore, Tamil Nadu, India Website: www.reactgroup.org.
39. Antibiotic Use and Resistance in Food Animals Current Policy and Recommendations, Center For Disease Dynamics, Economics & Policy 1400 Eye Street, NW Suite 500 Washington, DC 20005 USA, Chand Wattal, Sir Ganga Ram Hospital D. Agarwal, Consultancy Development Centre, 6.
40. Sanders FT "The Role of the EPA in the Regulation

of Antimicrobial Pesticides in the United States". *Pesticide Outlook*, 2003; 14(2): 251–255.
41. Osmon DR. Antimicrobial prophylaxis in adults. *Mayo Clin Proc*, 2000; 75: 98-109.
42. Crabtree TD, Pelletier SJ, Gleason TG, Pruett TL, Sawyer RG. Clinical characteristics and antibiotic utilization in surgical patients with *Clostridium difficile*-associated diarrhea. *Am Surg*, 1999; 65(6): 507- 511.
43. US Food and Drug Administration (FDA) Information for healthcare professionals: fluoroquinolone antimicrobial drugs. Accessed May 20, 2011.
44. Gerber MA, Baltimore R, Eaton C, et al. Prevention of rheumatic fever and diagnosis and treatment of acute streptococcal pharyngitis: a scientific statement from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the Council on Cardiovascular Diseases in the Young, the Interdisciplinary Council on Functional Genomics and Translational Biology, and the Interdisciplinary Council on Quality of Care and Outcomes Research. *Circulation*, 2009; 119: 1541-1551.
45. Blanco, G., J.A.Lemus, J.Grande, L. Gangoso, J.M.Grand e, J.A.Donazar, B. Arroyo, O. Frias, and F. Hiraldo. Geographical variation in cloacal microfloraandbacterialantibioticresistancein athre atenedavianscavenger in relation to diet and livestock farming practices. Environ. Microbiol, 2007; 9: 1738–1749.
46. Diarra, M.S., F.G.Silversides, F.Diarrassouba, J. Pritchard, L.Masson, R. Brousseau, C. Bonnet, P. Delaquis, S. Bach, B. J. Skura, and E. Topp. Impact of feed supplementation with antimicrobial agents on growth performance of broiler chickens, Clostridium perfringens and enterococcus number, antibiotic resistant phenotype, and distribution of antimicrobial resistance determinants in Escherichia coli isolates. Appl. Environ. Microbiol, 2007; 73: 6566– 6576.
47. Aarestrup FM, Seyfarth AM, EmborgH-D, etal. Effect of abolishment of the use of antimicrobial agents for growth promotion on occurrence of antimicrobial resistance in fecal enterococci from food animals in Denmark. Antimicrob Agents Chemother, 2001; 45: 2054–9.