ISSN:2521-0815 (Print)
ISSN: 2521-0432 (Online)

Contents List available at RAZI Publishing

Matrix Science Pharma (MSP)

Journal Homepage: http://www.razipublishing.com/journals/matrix-science-pharma-msp/

Lincomycin and tetracycline resistance in poultry. Review

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ARTICLE DETAILS

Article history:

Received 22 January 2017
Accepted 03 February 2017
Available online 05 February 2017

Keywords:

Lincomycin, Tetracycline, Feed Conversion Ratio, New Castle Disease, Infectious Bursal Disease, Immune Titer.

ABSTRACT

Antimicrobial agents are the most valuable means available for treating bacterial infections. Lincomycin and tetracycline are common brand having antibacterial activity. It is considered to be a cost-effective drugs because of its low cost, good activity against pathogenic anaerobic bacteria, favorable pharmacokinetic and pharmacodynamics. Antibiotic in the animal feed as growth promoters are primarily source of antibiotic resistance and stress factor for gut epithelium. Current studies will elaborate the advances in understanding toxicity induce by tetracycline and lincomycin on mucosal layer of gut of broiler. Following parameters such feed intake, weight gain and feed conversion ratio were studied on weekly basis which show FCR of the lincomycin group was greater as compared to tetracycline group and control group minimum FCR was found in tetracycline group. ND and IBD (New castle disease and Infectious bursal disease) titer was also affected.

1. INTRODUCTION

The fastest growing sources of meat and eggs in the world is poultry. Through this poultry source about one fourth of all meat is produced during the year 2000. Broiler available at market can be produced in less than six weeks through modern production unit. This was possible by genetic selection that results in improved health and feeding management. In intensive farming systems, bacterial diseases are treated by therapeutic agents and antibiotics. These therapeutic agents were used as growth promoters as well as prophylactic agents in feed and water of birds for example bacitracin, neomycin, oxytetracycline, avoparcin and lincomycin (Apata, 2009).

Animals are kept in large groups for meat production. Various antibiotics are used to enhance their growth rate and increase feed efficacy. Antibiotic are given to animals in their feed. The observable disadvantage is that diseased animals consume smaller quantities of antibiotics than the animals which are healthy. Antibiotics used in the feed for growth promotion is less as compared to the antibiotic used for therapy and prophylaxis. Antibiotics used as growth promoter can result in development of resistant bacteria (Henrik et al., 2003).

The authorized antibiotics broadly used in animal feed are lincosamides, tetracycline, trimethoprim, sulfonamides, macrolides, aminoglycosides, beta lactams and pleuromutilins. The usage of antibiotic in feeds is common to increase animal production rate, especially of chicken and pig (European Commission, 2010).

Antibiotics are use most commonly in human, animal husbandry, veterinary medicine, food technology and aquaculture. Antibiotic are mostly used in animals, including chickens for the treatment or prevention of diseases and to increase growth rate. During production of animals, antibiotics are used in large amount for control of various diseases. As a result, favorable environment has been created for development and spread of antimicrobial resistant microbes. Antibiotic resistant genes can be transmitted among different bacteria and from bacteria through food producing transmitted to human beings (Miranda et al., 2007, 2008; Aarestrup, 2005).

Growth promoters are biological and chemical substances widely used in animal and bird feed to improve body weight, feed efficacy and better production to attain excellent economic results (Peric et al., 2009). Discovery of antibiotics is the most important success in modern science and used to control bacterial diseases in humans and livestock. Application of antibiotics in medicine, agriculture and food industry is greatly increased since last 3 decades. Generally they are used for three purposes; in food producing animals such as, prophylactic reasons (control a disease), therapeutic reasons (treatment of a disease) and as, Growth promoters (sub-therapeutic dose of antimicrobials fasten growth rates of animals and increase feed efficacy) (Laxminarayan et al., 2015). Antibiotics used in animal feed to increase growth rate lead to better appetite, feed conversion, provocation of the immune system, improved energy and regulation of the intestinal micro-flora (Peric et al., 2009) as well as are major source of antibiotic resistance strains (Laxminarayan et al., 2015).

Lincomycin is a most commonly used antimicrobial agent used in animals and humans. It is generally used in poultry and dairy cattle for prevention and treatment of infection caused by gram positive pathogenic organism. The residues of antibiotics are present in animal products like eggs, meat and milk and may produce various adverse effects in consumers like development of bacterial resistance or allergic reactions (Eble et al., 1978).

Tetracycline is the most frequently used antibiotic families in the treatment and control of various animal diseases, especially in poultry farming. Tetracycline have the option of administration orally and the chance of major side effects is decrease. Therefore, they are extensive used in the treatment of humans and animals infections. Tetracycline is cheapest classes of antimicrobial available (Miranda et al., 2009; Chopra and Roberts, 2001).

2. LITRETURE REVIEW

The major public health problems have been appeared from pathogenic bacteria that developed the antibiotic resistance that led to increase discussion related to careful use of antimicrobial substances particularly medicine used in veterinary agriculture and nutrition. Since antimicrobial agents were used in treatment, prophylaxis and for growth promotion, their usage had played an important role in animal husbandry. Generally, in poultry chicks and animal husbandry, very large amount of anti-microbial substances were used as prophylaxis and in treatment as well. Such usage of antimicrobial agents was resulted in large exposure of animals to sub therapeutic dose of antimicrobial agents regardless their health status. For decades, a selective pressure has been exerted to target bacteria by antibiotics used in animals that were closely related to human treatment. It resulted in huge number of bacteria resistant to antimicrobials. If antimicrobial resistant bacteria in food animals became the part of human bacterial population, they threaten the drug's efficacy of human use. For example, Salmonella resistance was developed due to high frequency use of antibiotic of agriculture. Generally, resistance to infection of Salmonella was developed due to eating polluted food from animal's origin (Oliveiraa et al., 2005).

Antibiotic agents are mostly used in livestock production and in human medicine for more than 60 years in improving animal and human health but can also promote the spread and development of antibiotic resistant pathogens all over the world. This report emphases on specific problem of the commercial value of the antibiotic growth promoters (AGPs) to consumers and producers. After calculating orders of magnitude of modern antibiotic consumption in animals worldwide the report explores the potential adverse effects of limiting antibiotic which can increase growth rate in animal production worldwide. The response to increase use of antibiotic growth promoters seems to be minimize in optimizing production in comparison to financial influences. Antimicrobial growth promoters could be restricted in well-developed industrialized nations but is potentially greater in under developed countries with less developed production practices and hygiene (Laxminarayan et al., 2015).

Toxicologists, with upright reason, feel that the safety of life from chemical products through the business sectors rests mostly on their effort. But, one segment has received adverse care from the consumers, media, politicians, advisory groups and legislators in recent years. It is animal used for food production in serious systems and in those, many types of chemical added in the animal diets fed. No added substance received more unfavorable remark than those antimicrobial utilized for the goal of improving the efficacy of livestock production (Michael, P.D. et al., 2002).

During food animal production, antibiotics are used to treat and control microbial diseases, increase growth rate and ultimately production. It is documented that the use of antibiotic growth promoters in the feed are the main source of producing antibiotic resistant bacteria and resistant genes in the bacterial population, while as there are significantly reduction in bacterial resistance in Denmark after reduced use of antibiotic growth promoter. Judicious use of antibiotics can help to decrease the resistance and based on knowledge of the susceptibility of the microbes and human problems. Monitoring the development and occurrence of resistance and the usage of antibiotics are desirable, as in research most suitable ways to use antibiotics growth promoters in animals feeds (Aarestrup et al., 2005).

The overall increment in the utilization of anti-infection agents as an essential part of the animals and poultry industry for the treatment and control of bacterial infectious illnesses and to increase growth rate at low levels in feed has prompted the problem of the development of bacterial anti-infection resistance during the previous years. Recent experimental proof has demonstrated that resistant to anti-infection agents is not just because of the common capability of a tiny part of the microorganisms with surprising characteristics to survive antimicrobial attack, empowering resistant strains to divide, additionally transmit obtained resistant to their offspring and crosswise over to other irrelevant microscopic organisms species through additional chromosomal DNA piece called the plasmid which give a large number of various resistances. The rise and spread of safe bacterial strains like Campylobacter sp, Enterococcus sp. and Escherichia coli from poultry items to consumer put people at risk to new strains of microbes that oppose anti-microbial treatment. Resistant microscopic organisms defeat anti-infection agents by meddling with their mode of activity by means of a range of effectors' mechanism which including inactivating of proteins, variation in the shape of cell membrane or ribosome and alteration of cell carrier systems. These systems are particular to the kind of resistance created. In view of the developing worldwide concerns that resistance microbes can pass from animals to people, there is major increase in community and government attention for using wrong anti-microbial use in veterinary. Increase in the hygienic level of animal products and sufficient heat provided to eliminate the risk of antimicrobial resistant microbes surviving may play a major role in spread and prevention. More consideration should be centered around increasing anti-infection surveillance ability to adapt with the extent of developing resistances and on the other way to deal with sub-therapeutic anti-microbial agent in poultry, particularly the utilization of probiotic microorganisms that can positively impact poultry and create safe edible items (Apata et al., 2009).

Ofloxacin and ciprofloxacin have reported with 10 percent of resistant strains. Erythromycin has shown 39 % resistant strains, 19% clindamycin, 13% ofloxacin and 14% tetracycline in staphylococcus. It has observed that tetracycline, nitrofurantoin and erythromycin have 80%, 34% and 59% resistance in enterococci, respectively. It was found that the high incidence of resistant strains in poultry puts the public health at risk (Apata, 2009).

There is a creating discussion surrounding the utilization of antimicrobial agents used as to increase growth rate in animals used for food. These medications are used in less concentration in feeds of the animals and are measured to enhance the quality of the item, with a lower rate of fat and higher protein in meat. Utilization of any anti-microbial is associated with the determination of resistance in infectious microorganisms and it also contended that the utilization of anti-microbial to increase growth impose a choice for microscopic organisms which are resistant to anti-microbial agents that might be used as a part of veterinary or clinical practice, in this way the used of antibiotic chemotherapy is continued. In this paper considers the utilization of anti-microbial to increase weight gain and after that looks at an alternative techniques for accomplishing meat of good quality (Hughes et al., 2001).

3. Lincomycin as growth promoter

Lincomycin belongs to antibiotic class. It is produced by Streptomyces lincolnensis var. lincolnesis. There are many uses of lincomycin, for example, it is used in the treatment of staphylococcal, streptococcal, and Bacteroides fragilis infections. It has shown the activity against gram positive, gram negative and anaerobic bacteria. It also shows the activity against following organisms; aerobic gram-positive cocci: Streptococcus pyogenes and Viridans group streptococci; aerobic gram-positive bacilli: Corynebacterium diphtheriae; anaerobic gram-positive non-sporeforming bacilli: Propionibacterium acnes; anaerobic gram-positive sporeforming bacilli: Clostridium tetani and Clostridium perfringens (Proudfoot et al., 2007).

Table: Chemical properties of lincomycin

Chemical name	Lincomycin; Lincomicina; Lincomycinum
Molecular formula	C18H34N2O6S
Molecular weight	406.53736 g/mol

(Morar *et al.*, 2009).

Structure of lincomycin

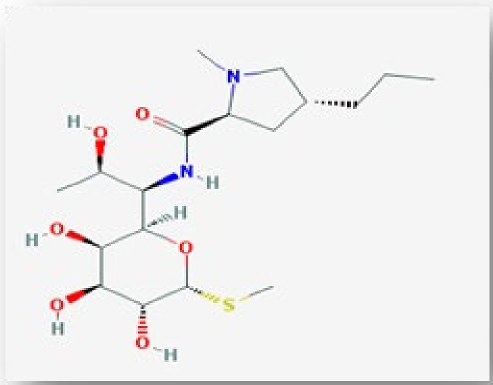

Fig: Structure of Lincomycin (Proudfoot et al., 2007)
Structure was prepared by using Chem Draw ultra

Effects of lincomycin in male broiler chicks were determined through an experiment in which lincomycin at the dose of 2.2mg/kg was given either in food or in drinking water (almost 0.5ml or equivalent amount). Experiment was comprised of total four treatments. One was control group without lincomycin, second group was containing 2.2mg of lincomycin per kilogram, control diet plus drinking water containing lincomycin at concentrations calculated to provide an intake equivalent to treatment 2, and treatment 14 with lincomycin concentration reduced by half. There was no considerable effect observed in any treatment on mortality, food utilization efficiency and final body weight of broiler chicks. It was concluded that the dose of lincomycin 2.2mg/kg may not be more effective in improving the performance of broiler chicks both economically and biologically (Proudfoot et al., 2007).

4. Mechanism of Action of Lincomycin

4.1 Protein Synthesis Inhibitor

Lincomycin binds to the 50S ribosomal subunit. It results in inhibition of protein synthesis. By this way, it produces the bactericidal effects in susceptible organisms. Antibacterial mechanism includes, disruption of peptide chain elongation, genetic code misreading, blockage of a site of ribosomes and oligosaccharides side chain's attachment to glycoprotein (Morar et al., 2009).

4.2 Absorption, Distribution and Excretion

Lincomycin absorption occurs in gastrointestinal tract (GIT). ts absorption occurs rapidly but partially up to 20-30%. It was confirmed that after the doral administration of 500 mg of lincomycin, the peak plasma concentration of lincomycin was 2-5µg/ml. It is reported that antibiotic activity persists for about 12 hours for most of the gram-positive microorganism. The important rout of excretion is bile and urine. Active form of drug found to appear in feces after oral and parenteral administration. Its excretion through both intestinal wall and bile was suggested (Morar et al., 2009).

4.3. Biological Half-Life

The plasma half-life of lincomycin is 4-6.4 hours in patients with normal renal function. The plasma half-life is increased in proportion to the degree of impairment in patients with reduced renal or hepatic function. Hundred plasma half-lives as high as 3 times normal have been reported in patients with severe renal impairment. The half-life may be two times normal in patients with hepatic impairment (Morar et al., 2009).

4.4. Metabolism/Metabolites

Lincomycin is partially metabolized in the liver, both drug, and metabolites are excreted in urine, bile, and feces (Morar et al., 2009).

4.5. Pharmacology of Lincomycin in Animals

Effectiveness of lincomycin (LINCOCIN) studied in experimental animals in vivo. Those animals were infected with Streptococcus viridans, β-hemolytic Streptococcus, Staphylococcus aureus, Diplococcus pneumoniae and Leptospira pomona. Infectiveness found against Klebsiella, Pasteurella, Pseudomonas, Salmonella and Shigella infections (Morar et al., 2009).

4.6. Lincomycin Uses

It was found that the main risk for incidence of antibiotics resistant strains is wide spread utilization of antibiotics. Variable level of resistance was shown by bacteria to antibiotics. For example, resistance of Encherichia coli and Staphylococcus sp. was observed 97% for tetracycline and 51% to ampicillin (Apata, 2009).

Antibiotic resistance elements were identified by array reaction within 4 hours. For developed by a scientist to find out the tetracycline resistance genes. Transfer and spread of antibiotic resistance genes (ARGs) and pathogenic potential of strains of Escherichia coli were recognized through this array. Microarrays have also been adopted to detect changes in cancerous cells in clinical cytogenetic laboratories. It was also studied that abnormalities in chromosomes have been detected by this microarray (McNeece et al., 2014).

4.7. Tetracycline

In studying tetracycline literature, it is clearly apparent that tetracycline is dynamic molecule. In few cases, the structure activity relationship are clearly known, mainly against microbes, while also against other agents, they are almost unknown. The activity and utility of the oxytetracycline are discovered and are also developing as new technological fronts. The articles which are published on tetracycline has reached to the number of 50,000 papers since 1948. Tetracyclines were discovered first by Dr. Benjamin Dugger of Lederle Research laboratory in mid 1940s as the product of fermentation of an uncommon golden colored soil bacterium properly named Streptomyces aureofacians. Tetracyclines are that class of antimicrobial agents which are able to prevent synthesis of protein in gram negative and gram positive microbes by inhibiting attachment of the aminoacyl-tRNA to the acceptor of ribosome. Tetracycline bind especially to the microbial ribosome and not especially with ribosomes of the eukaryotes. Tetracycline belong to an important class of commercially valuable and biologically active compounds. This condition may be simply explained by examining the most essential clinical application of tetracycline, their function as broad antibiotic spectrum for veterinary and human use. Tetracyclines has a dynamics entities which can possess unique biological and chemical characteristics that can explain their capability to interact with many different receptor, cellular properties and cellular targets (Domenico et al., 2012).

4.8. Mechanism of action

Mechanism of action of tetracycline can be divided into two main categories: “Typical”, if act as bactericidal; “atypical”, if they act as bacteriostatic. Characteristic tetracyclines bind specifically to the microbial ribosomal subunits. Most of them which do not contain ribosomes subunit as their primary target are atypical. Also, these atypical actions are toxic for both eukaryotes and prokaryote. Tetracyclines which are used in treatment have broad spectrum activity against microorganism (Nelson and Levy, 2011).

4.9. Tetracycline Generation

Tetracyclines are divided into first generation if they can be found by biosynthesis like: Chlortetecycline, Tetracycline, Demeclocycline and Oxytetracycline; second generation if they are the byproduct of semi-synthesis like: Lymecycline, Doxycycline, Rolitetracycline, Minocycline, Methacycline and Meclocycline; third generation if obtained from Tigecycline. But, some studies showed that Tigecycline is different from other tetracyclines and are classified as a new family of antimicrobial called Glycylcyclines (Domenico, 2012).

4.10. Tetracycline: as a growth promoter

Antibiotic used to increase animal growth rate controversial because it has potential to transfer of anti-microbial resistance from livestock to humans. Such exchange could have serious implication on public health in that treatment may be fail. In this review followed a danger assessment way to deal with assess approach alternatives for the streptogramin-class of anti-microbial: virginiamycin, animal growth promoter, and quinupristin/dalfopristin, anti-microbial used in human. Under the certain assumption that resistance exchange is possible, models project an extensive variety of results depending mainly on the fundamental conceptive number that determine the potential for individual to-individual transmission (Kelly et al., 2004).

Antibiotic resistance is a main human health crisis eroding the finding of antibiotics and their benefits to clinical prescription. There is general absence of knowledge of the significance of agriculture antibiotic used as a component in antibiotic resistance even among specialists in medicine and human health. This survey focuses on agronomic antibiotic medication use as an important driver of antibiotic resistance globally for the following four reasons: It is the major utilization of antibiotics around the world; a great part of the antibiotic used in agronomy may results in low concentration exposure of microscopic organisms; medications of every vital clinical class are used in agronomy; and population of human are expose to antibiotic resistant pathogens by means of consumption of livestock product and additionally release into environment (Ellen et al., 2008).

An inevitable effect of the utilization of anti-microbial agents is the dissemination and emergence of resistant microscopic organisms. Most prospective and retrospective studies demonstrate that after the administration of an anti-microbial not only at the level of resistance of infectious microorganisms, but can also increase commensal microscopic organisms. Commensal microscopic organisms constitute a reservoir of resistance gens for potentially pathogenic microorganisms. Its level of resistance is measured to be a good sign for determination of anti-microbial used and for resistance problem which are expected in pathogens. Commensal microscopic organisms of animals used for food purpose may be infected, as zoonotic microbes, meat and reach to the gastrointestinal tract of host. Checking the occurrence of resistance in microscopic organisms, for example, fecal enterococci and Escherichia coli in various population, patients, animals and healthy people, makes it practical to compare the predominance of resistance and with detect exchange of resistant microorganisms or resistance genes from livestock to human and vice versa. Besides, since the EU ban of avoparcin, a huge reduction has been seen in a few European nations in the occurrence of vancomycin resistant enterococci in fecal samples of healthy humans and food animals, meat and solid people, which highlights the function of antibiotics used in animals in the determination of bacterial resistance and the vehicle of these resistances by means of the food to humans. To save human health, the dissemination and selection of resistant microorganisms from livestock should be controlled. This can be achieved by decreasing the amounts of anti-microbial agents use in livestock (Anthony et al., 2000).

Animal production and feed efficiency are strongly related with the quantitative and qualitative bacterial load of the animal gut, the shape of the intestine wall and the action of the immune system. Antibiotic growth promoters have made major contribution to achieve success in animal husbandry, as an outcome of the increasing anxiety about the possibility for antimicrobial resistant strains of microbes, the European Commission decide to stop use all mostly used feed antimicrobial agents. There are various non-therapeutic choices, including organic acid, prebiotics, etheric oils, immune stimulants and enzymes (Huyghebaert et al., 2011).

Antimicrobial agents are mostly used in animal production for prevention and treatment of infection caused by microscopic organism and for increasing growth rate. Animals used as food are brought up in restricted conditions that increase the spread of bacterial infectious diseases. Antimicrobial agents are mostly used over alternatives, due to ready availability, often without prescription and of low cost, regularly without medicine. The majority of the antimicrobial agents used in food animal are similar to that used in humans. Some antimicrobial agents can increase mgrowth rate in the United States are medications characterized by the World Health Organization (WHO) as basic essential antimicrobial for use in human prescription. Resistance has produce to all antimicrobial agents which are used in animal feeds. The most critical driver of resistance determination and transport is antimicrobial use. In order to decrease resistance, use of antimicrobial agents to increase growth rate should be stopped. It is also recommended that antibacterial agents used in animal feed will lead to have serious consequence on human health by altering the gut microbiota concentration and quantity (Stuart et al., 2010).

Humans and animals constitute overlapping stores of resistance, and subsequently use of antibiotics in animals can effect on human health. The incidence of vancomycin resistant enterococci in animal is depended on the usage of avoparcin, a glycopeptide antimicrobial agent is added in the feed in order to increase growth rate in animals. Resistant Vancomycin enterococci and resistant vancomycin determinants can hence spread from livestock to humans. Bans on avoparcin and other antimicrobial agents which are used to increase growth rate in EU have provided researchers with a unique chance to examine the impacts of the removal of a most important antibiotic specific on the incidence and transfer of antibiotic resistance (Wegener et al., 1999).

Globally spread of antibiotic resistant microorganism in food animal is essential human health concern. Whilst several countries have applied antibiotics use policies and surveillance systems both in clinical and veterinary settings. All isolates were characterized for exposure to 11 antibiotic agents, including amoxicillin, tetracycline, chloramphenicol, ciprofloxacin, cefotaxime, gentamicin, streptomycin, kanamycin, sulphonamides and trimethoprim (Alcaine et al., 2015).

Food borne infections are presently known most important human health concerns, and are the major problems in society, affecting health status and causing medicinal expenses. Antibiotic medications have a major usage in human, horticulture, aquaculture and veterinary drug. Antibiotics are used in animals including poultry for the treatment or prevention of different diseases and to increase growth rate. High concentration of antimicrobial production (40%) in the USA was used in stock feeds which include 55-60% of tetracycline and penicillin creation. Tetracycline is generally used antibiotic in animal therapy, particularly in medicine and poultry farming (Arslan, 2015).

The precise estimation of tetracycline antimicrobial agents in complex matrices identified with raising poultry is essential for control of food. It was tentatively shown that deproteination techniques of conventional acid can increase release of tetracyclines since tetracyclines were powerfully bonded to aggregates of protein. To exclude this condition, an ultrasound assisted enzymatic hydrolysis procedure developed in order to break protein structures and release the bound tetracyclines (Zhou et al., 2014).

Antibiotic resistance was examined in 91 Salmonella enteritis which were isolated from broiler meat, human, poultry and food related samples began from South of Brazil. An increase concentration of resistant strains was founded, 90.1% showing resistant to antibiotics medication. There was decrease resistant to chloramphenicol (1.1%) and ampicillin (1.1%) and increase resistant to sulfonamides (75.8%) and nitrofurantoin (52.8%). Decrease levels of resistance were found for cefalotin (2.2%), trimethoprim (3.3%), norfloxacin (3.3%), gentamicin (5.5%), streptomycin (7.7%) and tetracycline (15.4%). Ciprofloxacin resistant was not recognized. A sum of 51.6% of S. enteritis strains were multi resistant and 18 resistance examples were found. The most resistance was found in strains from chicken related samples, where completely strains were resistant to one of the antibiotics. No prevalent resistance pattern was associated with phage type in our isolates. The increase number of antibiotics resistant S. enteritis present in Southern Brazil can show that the requirement for the prudent medications uses to reduce the spread and development of antibiotics resistance (Oliveira et al., 2005). Anadon et al. (1990) reviewed the present legislation for using of animal medicine in European Union, with important care to regarding security necessities. There seems to be an extensive acceptance of idea of risk investigation in regulatory assessment. The regulatory systems in force to conform that drugs residues and metabolites in their body do not increase hazardous thresholds. This review showed the standard method to assess the protection of chemical in feeds of animal origin which are intended for consumption in human. This review also explained the current achievement in antibiotic added in feed and its safety management in European Union. The antibiotic in feed, coccidiostats and other drug products approved in European Union (added substance/ animal species, content in feed, withdrawal period and maximum age) are introduced in tables form. Future deposit requirements for additives in feed are discussed. Attentions on the possible consequences of macrolides (spiramycin, tylosin), streptogramines (virginiamycin) and glycopeptides (avoparcin) on bacterial antibiotic resistance increase are introduced. At last, residue and pharmacokinetic data of some families of antibiotic compounds such as tetracyclines, amoxycilline and quinolones in pigs and poultry are presented. This information is required for the assessment of the usage safety of these animal drugs in food producing animals (Anadon et al., 1990).

Campylobacter and Salmonella infections occur usually in kids. Some infections are severe and needed to treat with antibiotics. Numerous classes of antibiotic which are used in food animals to increase growth rate, therapy and disease prevention are also used in humans. The use of such antibiotics in animals improves the probability that human microscopic pathogens are food animal reservoirs, for example, Campylobacter or Salmonella, will produce cross-resistance to approved medicine for use in human. Resistance may be spread from animals to human being through the supply of food with microorganism that generally are commensal, for example enterococci and Escherichia coli. A few European nations have shown that limiting the use of antibiotic in animals used for food can be followed by a decline in antibiotic resistance in people without compromising health of animal or the cost of production is significantly increasing. Proper use of antibiotic in people and animals used as a food is an important condition in maintaining their efficiency (Angulo et al., 2004).

In animals which are used for food purpose the development of resistant has been linked with the usage of antibiotics in animal husbandry. Therefore, some monitoring plans have been planned to check the incidence of antibiotic resistant bacteria. Examines the quantity of antibiotics used in nine European countries from 2005 to 2011, and compares by univariate analysis the associations between consumptions of the following antibiotic classes; macrolides, quinolones, cephalosporins, penicillins and tetracycline. An indication of resistance in commensal bacteria and zoonotic in Europe focusing on Enterococcus sp., Campylobacter sp., Escherichia coli and Salmonella during the same period of time based on checking programs is also measured. With the use of cephalosporins a linear regressions can showed strong positive relations between the usages of the following four different antibiotic classes. Significant differences among different countries have been detected in the concentration of antibiotic used to produce 1 kg of meat. Also, large difference in concentration of resistant microbes was described by the different countries which suggested differences in animal husbandry. Although the release of a particular antibiotic from ‘‘on farm’’ use, persistence over the years of microbes resistant to this specific antibiotic agent was still observed. There are also some variations in trends of resistance related to the specific species of animal. In order to compare the usage of antibiotic in the incidence of resistance, observation of consumption of antibiotic by species animal must be established. Subsequently some intervention strategies can be planned to decrease the incidence of resistance (Migura et al., 2014).

Use of antimicrobial agents to increase growth rate in feeds of animals has been allowed during the last 50 year in the countries of the European Union. The component of activity of antimicrobial agents to increase growth rate is associated with the interactions in intestinal bacterial population. This report investigates the European legislation history about the usage of antimicrobial agents in poultry feeds (Castanon et al., 2007).

Tetracycline as antibiotic growth promoters for example chlortetracycline, tetracycline, doxycycline and oxytetracycline have been played major role in feed additives. For the treatment of animals during infection because of their broad spectrum activity and economic advantages. Various study methods of tetracyclines are therefore have been described to check their residues in foods. Studies elaborated the new advances in chroudied matographic analysis methods for tetracycline use in foods (Oka et al., 2000).

Resistant tetracycline microbes were found in 1953 from Shigella dysenteriae, which is a bacterium and can cause bacterial dysentery. Later on resistant tetracycline microbes have been increasing in quantities of genera and species. This reduced efficiency of tetracycline treatment after some time. Resistance to tetracycline is usually because of the procurement of new genes frequently related with either a transposon or mobile plasmid. These resistance can be distinguishable from both biochemically and genetically. Resistance is mostly due to either ribosomal protection from the tetracycline action or energy dependent efflux of tetracycline. Tetracycline resistance specific genes are identified in 22 Gram-positive and 32 Gram-negative genera. Resistant tetracycline microbes are found in the normal flora of the species, opportunistic and pathogens. Resistant tetracycline microbes can be taken from human, livestock, environment and the food. The number of pathogens in the environments acts as reservoirs for the resistant antimicrobial genes (Roberts et al., 1996).

Since 1953, tetracycline resistant microbes have been present in greater concentration in animals, food, environment and humans. Resistance to tetracycline is usually because of the alteration in genomic of bacterial population and mainly because of energy dependent efflux of tetracycline or ribosomal safety from its potency. Gram negative efflux genes are normally related with the conjugative plasmids, however gram positive efflux genes are frequently found in the chromosome or mobilizable plasmids. Defensive genes of the ribosome are usually related with the conjugative transposons which have an inclination for chromosome. Recently tetracycline resistance genes are present in the genera Nocardia, Treponema, Streptomyces and Mycobacterium. The tetracycline determinant codes for protection of ribosomal protein which is found in opportunistic, pathogenic, aerobic, anaerobic, cell wall free, normal flora species, gram negative, and gram positive. This nature can be associated with the position on conjugative transposon and the capability to cross maximum physical and biochemical barriers present in microbes. We have assumed that the environment and mobility of the microbes can help influence the definitive range of host for particular tetracycline genes (Roberts et al., 1997).

Tetracycline resistance is mostly because of either efflux of tetracycline which is energy dependent or protection of microbial ribosomes from tetracycline action. The genes which encode resistance are generally acquired via transposons and/or transferable plasmids. Tetracycline determinants were found in a most of microbes and decrease the efficacy of treatment with tetracycline (Roberts et al., 1994).

Tetracycline has been a commonly used antimicrobial agent due to spectrum of activity and its low toxicity. But, its clinical efficacy has been decreasing due to the presence of greater number of resistant tetracycline isolates of clinically essential microbes. Predominate resistance mechanism are two types: ribosomal protection and tetracycline efflux. A third kind resistance mechanism is modification of tetracycline, has been recognized, however its clinical important is still imprecise. For some resistance genes of tetracycline expression is controlled. Gram positive efflux genes seem to be controlled by an attenuation mechanism. In recent times it was described that one of the protection genes of ribosome is controlled by attenuation. Resistance genes to tetracycline are found on transmissible compound. Resistant efflux genes are mostly present on plasmids, whereas ribosome protection genes have been present on both self-transmissible chromosomal component and plasmids. One class of transposon conjugate, formerly found in streptococci and can change itself from streptococci to variation of recipients which include other mycoplasmas, gram-positive and gram-negative microbes. Another class of transposons conjugate has been present in the Bacteroides group. An uncommon component of the Bacteroides compounds is that their exchange is increased by before tetracycline exposure (Speer et al., 1992).
The rapid occurrence of disease causing microbes resistant to other presently available antimicrobial agents and tetracyclines can cause severe concern among medical specialists. In this review mention the advances of tetracyclines before 1980. This analysis highlight the appropriate development in the field of tetracycline in the recent two decades which including advance progress on explaining the resistance mechanisms, and the progress of novel tetracyclines to control microbial resistance. In this review many new tetracycline derivative may be either isolated from fermentation or prepared semi synthetically. In the semisynthetic, efflux inhibitors which are effective in vitro model are recognized. Glycylcyclines which is the new class of tetracyclines is the subject of many reports and the most important focus of this study. Glycylcyclines are now the main derivatives that show antimicrobial activity as compare to the primary tetracyclines when introduced first. These antibiotics are effective against a wide range microbes which include strains that can carry the two important tetracycline resistance determinants, ribosomal protection and efflux. Glycylcycline derivatives DMG-DMDOT and DMG-MINO, have been examined by many groups of scientists against a many clinical pathogens from different sources. The range of action of these antibiotics includes those organisms which are resistant to these antimicrobial agents other than tetracycline, e.g., vancomycin resistant enterococci, penicillin-resistant streptococcus pneumoniae and methicillin-resistant staphylococci (Sum et al., 1998).

The tetracycline class of antibiotics shows a broad spectrum of action against various disease causing organisms, including gram-negative and gram-positive microbes and also different organisms. They are bacteriostatic in action, and bind to the 30S ribosomal subunit of bacterial ribosome and prevent synthesis of protein. The tetracyclines effectively used for the control and treatment of various diseases which include group acquired infection of the respiratory tract, diseases which can transmit sexually and in the control of acne. The tetracyclines are used for treatment of microbial diseases but its use has been decreased in current years due to the development of resistant organisms. The glycylcyclines show antimicrobial activities similar to tetracyclines are used earlier and more effective action against organism resistant to tetracycline with ribosomal mechanisms of resistance and efflux. Tigecycline is available only in injectable form for use in clinical not recently marketed tetracyclines which are present in oral forms. Volume of distribution of tigecycline is greater than other tetracyclines which range of 0.14 to 1.6 L/kg. While binding of protein is about 68%. Currently no man data are present which can describe the infiltration of tigecycline in tissue, while examine in rats using tigecycline which is radiolabelled and good infiltration into tissues. Half-life of tigecycline is 36 hours in mans, decrease than 15% is release unchanged in urine. Several studies in animal have been describing the effectiveness of tigecycline. Some human data are present about the drug interactions or antagonistic effects resulting from tigecycline therapy; but, preliminary data showed that tigecycline safely used and is well tolerated then the antagonistic effects experienced for tetracyclines i.e. headache, nausea and vomiting (Zhanel et al., 2004).

5. Development of antibiotic resistance in poultry

It was found that the main risk for incidence of antibiotics resistant strains is wide spread utilization of antibiotics. Different level of resistance has shown by bacteria against antibiotics. For example, the resistance of Encherichia coli and Staphylococcus sp. observed 97% for tetracycline and 51% to ampicillin (Apata, 2009).

A technique for gene detection has been ranged from simple Polymerase Chain Reaction (PCR) to techniques based on hybridization such as micro and macro array techniques. The main use of these techniques is to recognize Antibiotic Resistance Genes (ARGs) in samples of bacteria. In bacterial DNA, gene is present as a spot. For identification of ARGs and bacterial genotype, these arrays have used most commonly. For example, glass based developed by a scientist to find out the tetracycline resistance genes. The transfer and spread of Antibiotic Resistance Genes (ARGs) and pathogenic potential of strains of Escherichia coli recognized through this array. Microarrays have also adopted to detect changes in cancerous cells in clinical cytogenetic laboratories. It was also studied that abnormalities in chromosomes have detected by this microarray (McNeece et al., 2014).

6. New Castle Disease (ND)

A viral disease called New Castle Disease, chicken are mainly affected by it. It is caused by avian paramyxovirus serotype 1 (APMV-1) (NDV) of the genus Rubulavirus that belongs to the subfamily Paramyxovirinae, family Paramyxoviridae, order Mononegavirales. The main constraint in low production was different types of diseases especially New Castle Disease (ND) due to which investments in this system was disturbed. Therefore, by successful control of ND any improvement for free range village chickens can be made and it can be controlled by vaccination. In 1926, this disease was first reported in Java and has been endemic in Tanzania. But it was observed that ND is a wide spread disease and have different names depending upon locality for example “Kideri, Mdonde, Mdondo” in Swahili, while “Kifwa” or “Ikula” in Nyamwezi and Sukuma, respectively. In literature this names means plague and fatality and farmers in Tanzania considered it as the killer disease for village chickens (Mohammed et al., 2013).

7. Infectious Bursal Disease (IBD)

Worldwide, Infectious Bursal Disease (IBD) has a wide distribution, but there was no reported case of IBD in Ethiopia. This was due to indigenous chicken’s resistance to Infectious Bursal Disease Virus and other viruses as well. It was observed that emergence of diseases has a large concern because of rising chicken farming at commercial scale. This reported case observed in 20-45 day old layer and broiler chicks. In these chicks, the level of water and feed consumption dropped rapidly, diarrhea was also a common problem. The prominent clinical symptoms observed; rapid drop of water and feed intake, white creamy diarrhea, mass death, weight loss and soiling of vent and recovered broilers remained underdeveloped. After observable symptoms, high mortality started on the 3rd day and remained continues up to the 15th day of trial. For both, layers and broiler chicks, the overall mortality rate was 49.89% at the end of 8th week. While mortality rates in the layer were 25.1% and 56.1% in broiler chicks. In the 3rd week of age, the disease’s onset and appearance of symptoms, both were compatible with the clinical type of the disease (Mohammed et al., 2013).

CONCLUSION

Lincomycin resistance was found in broiler which shows zero zone of inhibition against Salmonella Typhi, Sthyphylococcus Aureus and E. coli while Tetracycline shows zone of inhibition against these microbes. Antibiotic titer was found high in tetracycline group for both ND and IBD while in lincomycin show decrease titer. FCR of the lincomycin group was greater as compared to tetracycline group and control group minimum FCR was found in tetracycline group. Present study suggests that the antibiotics in the animals feed as a growth promoter can increase growth rate but result in the development of resistance. Therefore, it is needed that antibiotics in animal feed as growth promoter should be stopped to prevent antibiotic resistance and gut toxicity.

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