Poultry Science Journal
ISSN: 2345-6604 (Print), 2345-6566 (Online)
http://psj.gau.ac.ir

GUASNR

Evaluation of Drug Interactions and Prescription Errors of Poultry Veterinarians in North of Iran

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Poultry Science Journal 2014, 2 (1): 25-35

Article history:
Received: June 23, 2013
Accepted: Feb 20, 2014
Available online: March 15, 2014

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Keywords:
Poultry
Antibiotic
Drug interaction
Prescription error

Abstract

Drug prescription errors are a common cause of adverse incidents and may lead to adverse outcomes, sometimes in subtle ways, being compounded by circumstances or further errors. Therefore, it is important that veterinarians issue the correct drug at the correct dose. Using two or more prescribed drugs may lead to drug interactions. Some drug interactions are very harmful and may have potential threats to the patient's health that is called antagonism. In a survey study, medication errors of 750 prescriptions, including dosage errors and drug interactions were studied. The results indicated that 20.8% of prescriptions had at least one drug interaction. The most interactions were related to antibiotics (69.1%), Sulfonamides (46.7%), Methenamine (46.7%) and Florfenicol (20.2%). Analysis of dosage errors indicated that total drugs consumed by broilers in the summer are more than winter seasons. Based on these results, avoiding medication errors are important in the balanced prescribing of drugs and regular education of veterinary practitioners in a certain interval is needed.

Please cite this article as: Madadi MS, Bojmehrani H & Azari M. 2014. Evaluation of drug interactions and prescription errors of poultry veterinarians in north of Iran. Poult. Sci. J. 2 (1): 25-35.

Introduction

Drug prescription errors are a common cause of adverse incidents and may be largely preventable. A medication error is any preventable event that may cause or lead to an inappropriate medication use or patient harm and a substantial increase in patient morbidity and mortality rates. In medicine, 30% of the hospital problems are associated with drug administration errors. Errors may occur throughout the entire drug distribution system, from prescribing to the administration of drugs (van den Bemt *et al.,* 2002). The administration of drugs is a very critical step because the possibilities of correcting errors at this stage are limited and errors at this level may directly harm the patient (Ito and Yamazumi, 2003). These pharmaceutical errors can result in serious health complications including allergic reactions, organ damages caused by overdose, infection, stroke, heart failure, liver and kidney failures, weight gain/loss, and even death (Rosenfeld, 2010). Common causes of medication errors include incorrect diagnosis, prescribing errors, drug dose miscalculations, poor drug distribution practices, drug, device related problems, incorrect drug administration, wrong drug labeling and lack of bird keeper education (Aspden *et al.*, 2007). Any mistakes in prescribing a drug can lead to a significant increase or decrease in the efficacy and intensity of the prescribed drugs and increase the risk of harm to the diseased farms (Pudasaini *et al.*, 2011).

Medication errors may also be due to drug interactions. Drug interactions can involve with other drugs or foods, beverages, and dietary supplements such as vitamins, minerals, amino acids, herbs or botanicals. Drug interactions can reduce the effectiveness of drugs (antagonism), cause unexpected side effects or increase the action of a particular drug (synergism). Drug interactions with food and beverages might result in delayed, decreased, or enhanced absorption of a medication (Rosenfeld, 2010).

Factors that may increase the side effects of drug interactions include: multiple pharmacological effects of a particular drug (Aronson, 2009; Plumb, 2008), using multiple prescriptions in a same time (Ito and Yamazumi, 2003), using drugs without the veterinarian's advice, improper use of drugs and co-administration of two or more high potency drugs on a same poultry farm (Aspden *et al.*, 2007). Drug interaction side effects may be confounded by acute disease signs or lack of a clear way to evaluate the drug interactions.

Dose of the prescribed drugs is the amount of drugs recommended by the manufacturers to exert its main therapeutic properties. The best and most accurate method to determine the dosage of an antimicrobial medication is to make calculations on the basis of mg of the prescribed drugs in the medication per Kg body weight (real dosage). Calculating the dosage of an antimicrobial medication on the basis of units per volume of drinking water is an easy and convenient method that poultry veterinarians use in the practical form (parts per thousand: Commercial dosage form) but this is certainly not accurate, because there are considerable variations in water consumption of poultry flocks in different

seasons. These variations in water consumption affect the total amount of a medication consumed daily by the flocks. Drinking water is the most favored method of administration. The important advantages are the low cost of organization, low workload, the ease of administration, immediate therapeutic care for all diseased or endangered animals in the farm and a quick change of drug and/or dose that is possible. The main disadvantages are drug uptake can vary dramatically as a function of the animal, season, age and weight of birds, unprofessional use of the medication and preparation of the solution by the farmer (Tahseen, 2002).

The present study was aimed to assess the prevalence of drug interactions and dosage errors in the prescriptions administered by the poultry veterinarians in north of IRAN; in order to improve the quality of drug therapy, prevention of medical side effects, reducing mortality rate and medical costs.

Materials and Methods

A retrospective audit of prescriptions, generated during the period of January–August 2012 and 750 prescriptions from 75 poultry veterinarians were analyzed. Indicators of drug use pattern include average number of drugs prescribed per encounter, interactions between prescribed drugs, type of drug interactions and dosage errors. The prescription errors were compared with standards indicated in the handbook of veterinary drugs compiled by Plumb (2008) (Table 1). Dosage errors were more performed on ten commonly used antibiotics include: Erythromycin, Sulfadimidine, Flumequine, Enrofloxacin, Sultrim, Lincomycin, Oxytetracycline, Neomycin, Tylosin and Tiamulin.

Table 1. Commercial and real dosage of antibiotics

Antibiotic	Real dosage[1]	Commercial dosage[2]
Erythromycin	20	1
Sulfadimidine 33.3%	140	2
Flumequine	12.5	0.5
Enrofloxacin	10	0.5
Sultrim (Sulfadiazine/Trimethoprim)	45	0.33
Lincomycin 40%	10	0.07
Oxytetracycline 20%	10	0.5
Neomycin 20%	20	1
Tylosin	50-100	0.5
Tiamulin	15-20	0.5

[1] mg of antibiotics per Kg of live body weight.
[2] mg of antibiotics per 1 Liter of drinking water.

Results and Discussion

The results indicated that 112 prescriptions (15%) contained one drug, 540 prescriptions (72%) two or three drugs and 97 prescriptions (13%) contained four

or more than four drugs. The mean number of drugs was 2.49 per every prescription. The most commonly used items in prescriptions were antibiotics (92%) and multivitamines (37.2%). The number of prescriptions contained two and three antibiotics were 334 (44.5%) and 61 (8.1%), respectively. The most commonly prescribed antibiotics were Sulfonamides, Tetracycline and Enrofloxacin. The results showed that 156 prescriptions had at least one drug interaction (20.8%) and more than one interaction was observed in 9 prescriptions. The most interactions were related to antibiotics with antibiotics (69.1%). Sulfonamides (46.7%), Methenamine (46.7%) and Florfenicol (20.2%) had the greatest interaction between antibiotics. The results indicated that 40.4% of the errors were minor or had no adverse effects, but 59.6% of the errors were considered moderately significant (Table 2).

Table 2. Classification of drugs interaction significance

Interaction type	Percent	Severity
Methenamine and Sulfonamides	37.2	Moderate
Florfenicol and Bactericide antibiotics	20.2	Moderate
Aminoglycosides and Enrofloxacin	2.2	Moderate
Bacitracin and Methenamine	9.5	Minor
Sulfonamides and Multivitamins	9.5	Minor
Oxytetracycline and Ca content mixtures	11.9	Minor
Enrofloxacin and Minerals	9.5	Minor
Total	100	

As the results showed, 85% of prescriptions contained two or more drugs and antibiotics were most frequently prescribed. The incidence of prescribing errors was 20.8% and the most interactions were related to the antibiotics with the other drugs. The large number of prescription errors could partially be explained by lack of the diagnosis and poly-pharmacotherapy of the diseased birds based only on the clinical diagnosis (Aronson, 2009).

The volumes of real and commercial dosages of antibacterial agents were calculated for the winter and summer seasons. Birds consume more water in the summer and so volumes of antibacterial commercial dosages in the summer season were more than the winter seasons (Figures 1, 2, 3). Commercial dosages of Erythromycin, Sulfonamides, Flumequine and Enrofloxacin in the early ages of birds, (especially in the winter season) were equal to the real dosages of these antibiotics. However, with increasing the birds age, the volumes of commercial dosages were more than the real dosages in the summer season, except for Flumequine which was lesser after 35 days of the age. In the winter season, the commercial dossages of these antibiotics were slightly higher than the real dossages and gradually decreased with increasing the birds age, especially for Flumequine and Enroflaxin (Figures 1a, b, c and d).

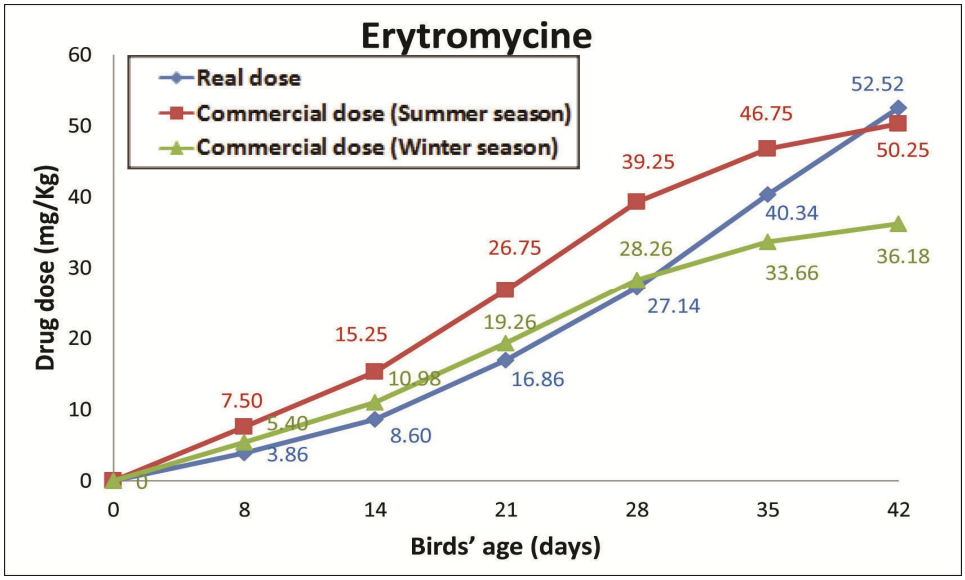

Figure 1a. Comparing commercial dosages and real dosage of Erythromycin in the rearing period.

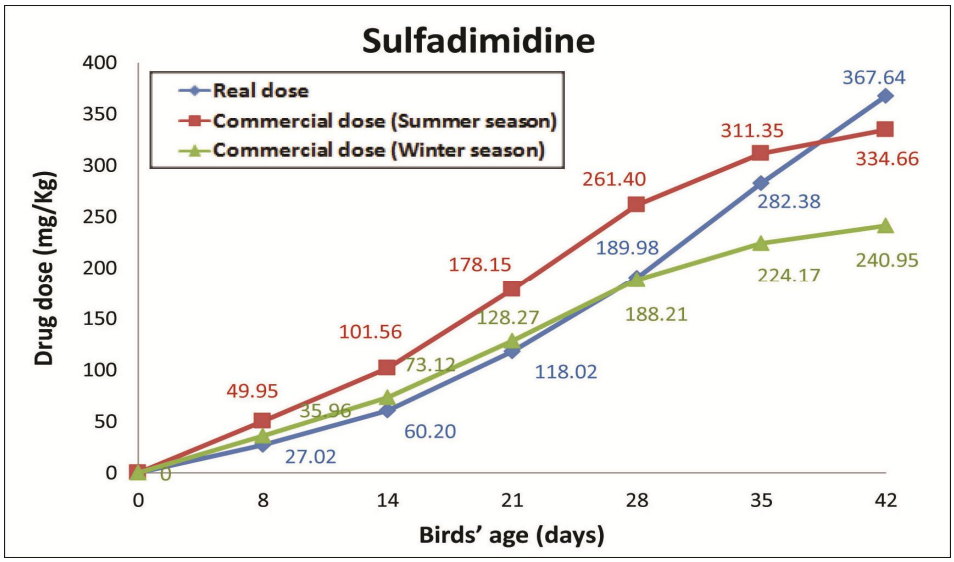

Figure 1b. Comparing commercial dosages and real dosage of Sulfadimidine in the rearing period.

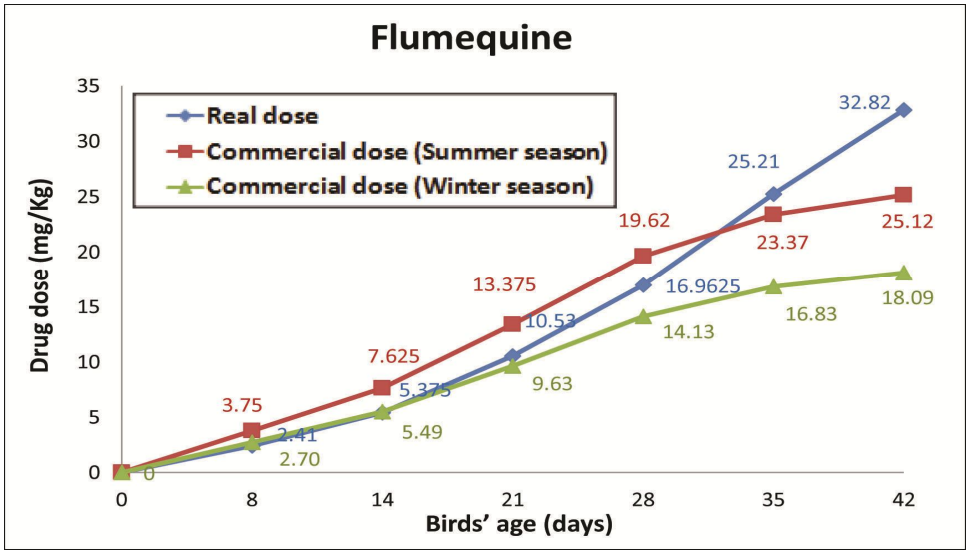

Figure 1c. Comparing commercial dosages and real dosage of Flumequine in the rearing period.

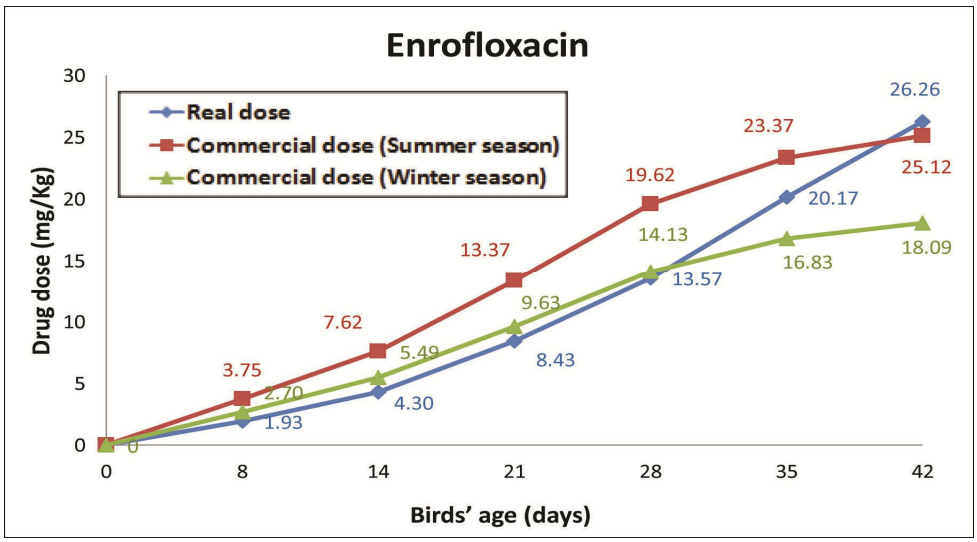

Figure 1d. Comparing commercial dosages and real dosage of Enrofloxacin in the rearing period.

Commercial volumes of Sultrim were always less than the real dose in the winter and summer seasons (Figure 2a). Commercial volumes of Lincomycin in the winter season and after 21 days of age in the summer season, were less than the real dose of this drug (Figure 2b).

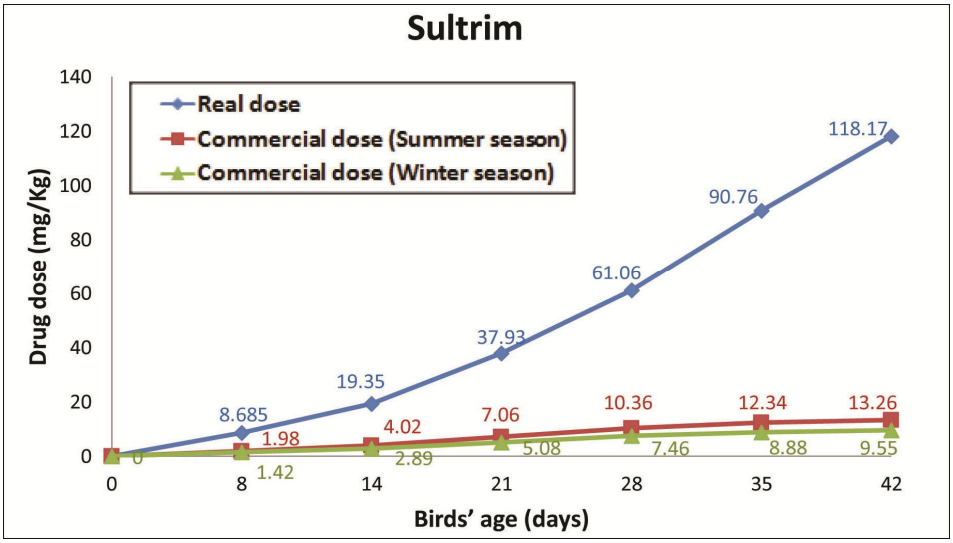

Figure 2a. Comparing commercial dosages and real dosage of Sultrim in the rearing period.

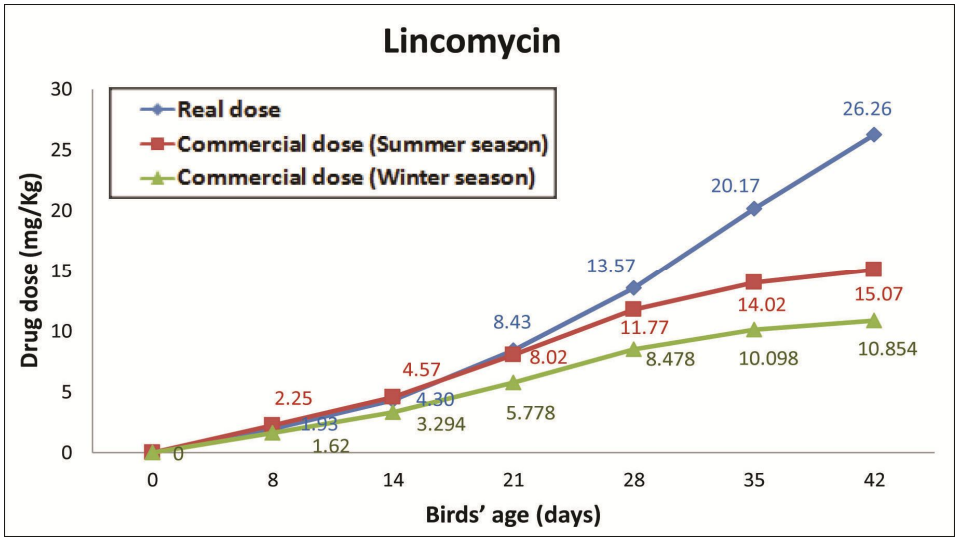

Figure 2b. Comparing commercial dosages and real dosage of Lincomycin in the rearing period.

In comparison with Sultrim and Lincomycine, Oxytetracycline, Neomycine, Tylosin and Tiamulin took more drug volumes in both summer and winter seasons and their commercial doses were more than the real dose in all seasons and ages (Figure 3a, b, c and d).

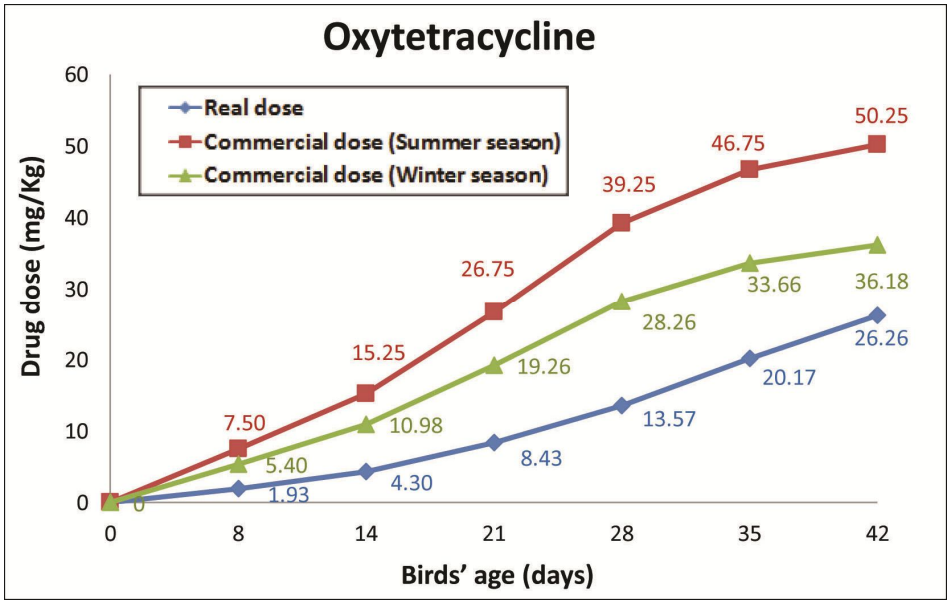

Figure 3a. Comparing commercial dosages and real dosage of Oxytetracycline in the rearing period.

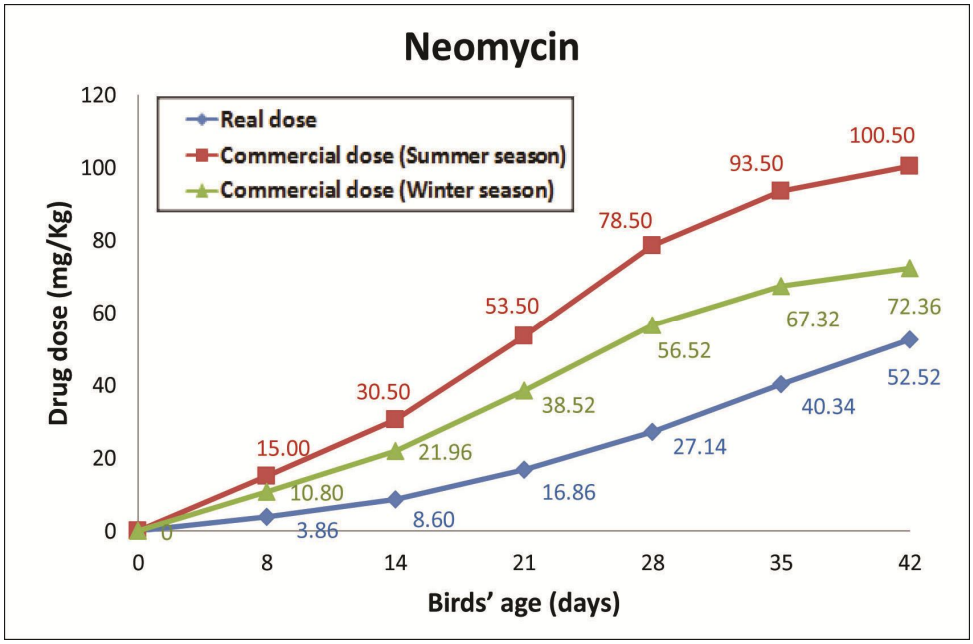

Figure 3b. Comparing commercial dosages and real dosage of Neomycin in the rearing period.

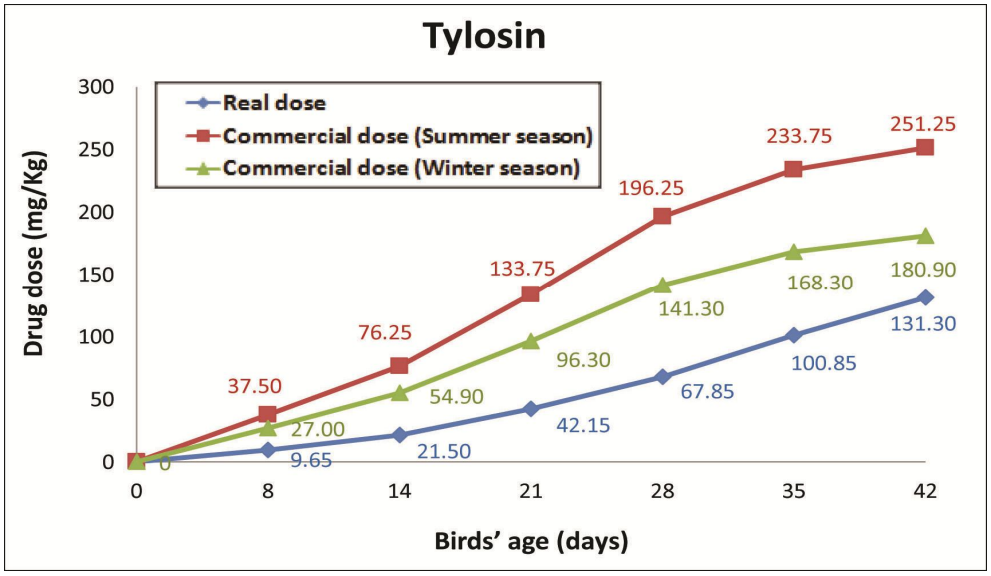

Figure 3c. Comparing commercial dosages and real dosage of Tylosin in the rearing period.

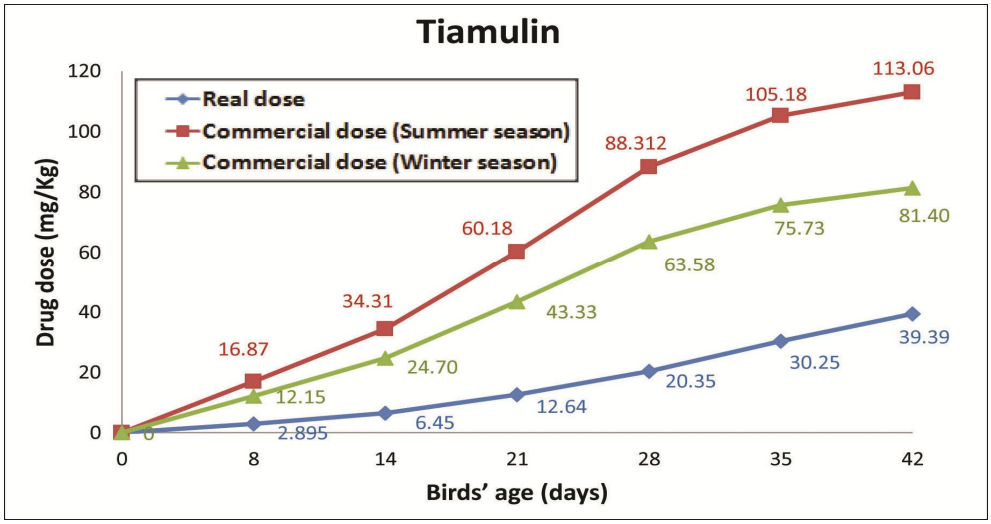

Figure 3d. Comparing commercial dosages and real dosage of Tiamulin in the rearing period.

The commercial volumes of Lincomycine and Sultrim were less than the real dosages of these antibiotics at all seasons. This can be explained by the insufficient effect of these drugs in the treatment of bacterial infections. For an antimicrobial drug to be effective, the birds must receive the correct dosage. Under-dosing may

be ineffective and can result in treatment-failures. The insufficient effect of antibiotics, is sometimes wrongly attributed to the antibacterial resistance. In contrast to the previous drugs, commercial dosage consumptions of Oxytetracycline, Neomycine, Tylosin and Tiamulin were much more than the real dosages (Figure 3). Drug over-dosages will increase the cost of medication, lead to the antibiotic resistance, cause harmful drug interactions and can be toxic and lead to possible liver and kidney damages.

In a related study, Katherine (2002) studied the incidence of interactions in small animal intensive care unit patients. Ninety-seven significant interactions were found between 801 records (12.1%) and animals were given a mean of 3 drugs during hospitalization.

The occurrence of drug interactions in poultry veterinarian prescriptions has not been previously studied. This study showed that drug interactions and dosage errors are common in poultry veterinarian prescriptions (1 in 5 prescriptions). Poultry veterinarians should avoid medication errors and calculate the dosage accurately on the basis of average body weight of birds in the flock to be medicated.

It is recommended that there should be an intervention program involving concerted continuing education of poultry veterinarians in a certain interval, establishment of standard treatment guidelines, continuous survey of prescriptions, labeling drugs with real dosages and encourage veterinarians to administer drugs based on the real dosages.

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