

Full Length Research Paper

Impact of Tiamulin and Pulmotil on Production Parameters, Lesions, and Mortality in CRD-Infected Poultry

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Chronic respiratory disease (CRD) is one of the most important veterinary diseases in Iran and all over the world. Mortality, reducing of weight gain and increasing of feed conversion ratio (FCR) are caused by CRD. Several drugs are used for prevention and control of CRD. CRD is caused by *Mycoplasma gallisepticum* (MG). Tiamulin and pulmotil are effective on *M. gallisepticum*. By considering generating resistance against antibiotics that is effective on MG, studying the effect of these drugs in the treatment and prevention of CRD in birds were the purpose of this research. In this study, tow broiler flock (MG positive) and layer flock (MG free) with 15000 birds, divided in six similar groups (A, B, C (layer), D, E and F (broiler)) with 2500 bird in each group. 13 and 100 g tiamulin in 200 L of water was used in Groups A and D, respectively. 60 ml pulmotil in 200 L of water was used in Groups B and E at the same time. However, the birds in Groups C and F (control groups) did not get any antibiotic. Gross lesions and mortality of CRD, minimum inhibitory concentration (MIC) of tiamulin, pulmotil and other common antibiotic dicks, hen-day percentage in layers and growth parameters in broilers of control and experimental groups were calculated. The basis of ANOVA analysis was that the use of antibiotics such as tiamulin and pulmotil significantly reduced mortality and gross lesions ($P < 0.05$). Also, it improved hen-day percentage in layers and growth parameters in broilers ($P < 0.05$). It can be concluded that usage of these antibiotics can be essential in the treatment and prevention of CRD in birds.

Key words: Pulmotil, tiamulin, chronic respiratory disease (CRD), birds, minimum inhibitory concentration (MIC).

INTRODUCTION

Mycoplasma gallisepticum (MG) infection is commonly known as chronic respiratory disease (CRD) in chickens and infectious sinusitis in turkeys (Bozorgmehri et al., 1998). MG infection causes significant economic losses to the poultry industry throughout the world. It causes a reduction in egg production of 10 to 20%, an increase in embryo mortality and chick mortality of 5 to 10% and a reduction in weight gain and feed conversion ratio (FCR) by 10 to 20% (Wary and Davies, 2002). MG predisposes birds to other infectious agents, such as *Escherichia coli* and *Haemophilus paragallinarum* through the inhibition of

immune functions (Laber and Schütze, 1977).

In the complicated infections, the severity of the disease is greatly affected by the degree of secondary infection with viruses, such as Newcastle disease and infectious bronchitis, and/or bacteria, such as *E. coli* (Faghihi, 1993).

There is a variety of antibiotics available in the market, but little data are available regarding the efficacy of these antibiotics against the local isolates of the MG. By considering a great use of antibiotics that have effect on MG, a lot of MG isolation holds on against these antibiotics, but new drugs, such as tiamulin and pulmotil can be very beneficial in control and prevention. Therefore, the present study was conducted to study the efficacy of different antibiotics being used against MG in broilers in the prevailing field situation (Kjan et al., 2006).

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Table 1. The comparison of laying and mortality in different groups at different weeks of production in laying hens.

week or production	Hen-day egg production (%)			Mortality		
	Tiamulin	Pulmotil	Negative control	Tiamulin	Pulmotil	Negative control
20	12.4	12.40	12.70	-	-	-
21	29.2	29.50	28.70	-	2	-
22	48.9	50.00	49.60	1	1	-
23	73.0	71.30	69.10	-	-	5
24	85.0	84.70	83.20	-	-	2
25	88.9	89.00	87.50	-	2	7
26	91.0	91.00	89.70	2	1	3
27	93.2	92.90	90.80	-	-	4
28	93.8	93.90	92.10	3	-	2
29	92.9	92.70	92.00	1	1	1
Total	-	-	-	7 ^a	7 ^a	24 ^b

^{a,b}Means with unlike superscripts letters differ ($P < 0.05$).

MATERIALS AND METHODS

This study was done in laying farm (MG free) and broiler farm (MG positive) with 15000 birds. The study was established in 6 groups including 2500 bird per group. Drinking water of groups A and B contain 13 g/200 L tiamulin and 60 ml/200 L pulmotil, respectively that have been supplied for 2 month (18 to 27 weeks old) as 2 days in a week, whereas group C had no antibiotic supplement. In the broiler farm, drinking water of groups D and E contain 100 g/200 L tiamulin and 60 ml/200 L pulmotil, respectively that have been supplemented for 5 days (4 to 9 days old), but group F drank water with no antibiotic. Vaccination, nutrition, environmental condition and management in all groups were same.

At the end of 2 months period, egg production, in layer flock body weight gain and FCR, in broiler flock necropsy finding and mortality in all groups caused by CRD and other lesions, were measured (Kjan et al., 2006, Youxiang et al., 2008). To investigate the effects of tiamulin and pulmotil along with other effective drugs on *Mycoplasma* (tylosin, enrofloxacin, doxycycline and erythromycin) in both layer and broiler flocks, pleuropneumonia-like organisms (PPLO)-Broth culture media, PPLO-Agar and minimum inhibitory concentration (MIC) test have been done (Kjan et al., 2006, Wary and Davies, 2002). The results were analyzed in ANOVA method by SPSS (version 15) software.

RESULTS

Prevention levels of tiamulin and pulmotil in laying hens

Mortality, egg production and MIC were evaluated in layer flock. Egg production in Group A, treated with 13 g of tiamulin, in relation to both Group B (treated with 60 ml of pulmotil) and negative control Group C (with no antibiotic supplement) were 92.8, 92.4 and 92%, respectively, but this difference was not significant ($P > 0.05$). Mortality rate in Groups A and B was 7, that is, significantly low than Group C that was 24 ($P < 0.05$). The symptoms of dead birds in Group C were oviduct infectious (salpingitis) and in some cases airsacculitis as

defined in Table 1.

Treatment levels of tiamulin and pulmotil in broilers

Mortality, growth parameters and MIC were evaluated in broiler flock. Average weight in flock D (Tiamulin) and E (Pulmotil) were 2530 ± 150 and 2500 ± 140 g, respectively; that was significantly higher than negative control group E (1620 ± 225 g) ($P < 0.05$). Mortality rate in group D and E was 21 and 29, respectively, and that was significantly fewer than positive control group F (153) ($P < 0.05$). 138 dead birds of all 153 dead had been caused by CRD and CRD-complex with airsacculitis, pericarditis and perihepatitis as defined in Table 2.

MIC test of tiamulin and pulmotil

Three (3) isolates of *M. gallisepticum* were separated in PPLO-Agar and PPLO-Broth culture media and the MIC for tiamulin, pulmotil, tylosin, doxycycline, enrofloxacin and erythromycin, was determined (Table 3). Tiamulin had the smallest MIC (0.089) and pulmotil at the second level (0.128) was the most effective drugs in the test. Doxycycline had the greatest MIC (1.680) and showed that *Mycoplasma* have relative resistance to this antibiotic as defined in Table 3.

DISCUSSION

One of the most important concerns in international trade is the necessity and ability of *M. gallisepticum* infection state determination in products (mostly hatch able eggs in one-day old chicks) (Faghihi, 1993).

Mycoplasmas are very resistant against antibiotic like penicillin that influences the cell wall. Antibiotic like

Table 2. The comparison of growth parameters in different groups at different weeks of breeding in broilers.

Breeding week	Average weight (g)			FCR			Mortality		
	Tiamulin	Pulmotil	Positive control	Tiamulin	Pulmotil	Positive control	Tiamulin	Pulmotil	Positive control
1	158 ± 72	158 ± 45	156 ± 50	1.12	1.1	1.18	-	5	3
2	412 ± 100	405 ± 92	375 ± 62	1.25	1.23	1.31	7	5	8
3	845 ± 89	825 ± 98	650 ± 98	1.32 ^a	1.34 ^a	1.59 ^b	2	-	4
4	1410 ± 115 ^a	1395 ± 124 ^a	1052 ± 128 ^a	1.48 ^a	1.46 ^a	1.69 ^b	3	4	12
5	1850 ± 135 ^a	1870 ± 148 ^a	1375 ± 200 ^a	1.60 ^a	1.58 ^a	1.87 ^b	5	7	39
6	2530 ± 150 ^a	2500 ± 140 ^a	1830 ± 225 ^a	1.74 ^a	1.73 ^a	2.39 ^b	4	8	85
Total	2530 ± 150 ^a	2500 ± 140 ^a	1830 ± 225 ^a	1.70 ^a	1.69 ^a	2.22 ^b	21 ^a	29 ^a	153 ^b

^{a,b}Means with unlike superscripts letters differ (P < 0.05).

Table 3. MIC results of tiamulin, tylosin, doxycycline, enrofloxacin, pulmotil and erythromycin.

MG isolates	Inoculum number of Myco/0.2 ml	Enrofloxacin	Erythromycin	Pulmotil	Tylosin	Tiamulin	Doxycycline
1	1.9 × 10 ⁵	0.985	0.895	0.245	0.339	0.124	1.32
2	2.3 × 10 ⁵	0.775	1.23	0.128	0.339	0.089	0.89
3	2.7 × 10 ⁵	0.882	1.56	0.128	0.129	0.124	1.68

macrolides (erythromycin, tylosine and kitasamycin), lincosamides (Linkomycin), tetracyclines (oxytetracycline, chlortetracycline and doxycycline) and tiamulin which inhibits protein synthesis, are used to treat MG infection (Aiello and Mays, 1998). Drugs influencing DNA synthesis (Norfloxacin and danofloxacin) are also recommended, (Allen et al., 1993).

Generally, drugs like tiamulin and enrofloxacin that aggregate on respiratory and genital-urinary organs mucus are preferred. Successful treatment of infectious flocks improves clinical signs and production (body weight, FCR and egg production) and decrease necropsy finding and mortality (Bozorgmehri et al., 1998).

One of the important factors in successful control of *Mycoplasma* infections by these antibiotics is selection and proper use of them in order to get effective level of drug in blood. Variables like birds' age, environment temperature, drug levels and drug-water palatability are able to influence the water consumption and drug intake level. Otherwise, pharmacologic properties of drug products like as absorption, diffusion, metabolism and excretion, are effective on drug level in blood (Wary and Davies, 2002).

As the resistance rate in bird body against some drugs have been reported, to access good results, antibiotic sensitivity determination test, might be useful. Avian *Mycoplasma* resistances to a few antibiotics have been studied for a 25 years period from 1975 until 2000 in Britain. The study was done on 241 *Mycoplasma* isolates, and showed that none of them were observed of enrofloxacin at marginal level.

In *Mycoplasma synoviae* like *M. gallisepticum*, none of the 105 isolates under study was resistant against

tiamulin and enrofloxacin, but their resistance against tylosine and oxytetracycline was in increase. Also, 25 isolates of *Mycoplasma meleagridis* studied and the result showed that they had a little resistance against tiamulin and enrofloxacin, but their resistance to tylosin, oxytetracycline and linkomycine had a significant increase. *Mycoplasma iowa* was not resistant to tiamulin and enrofloxacin, but resistance to tylosin, oxytetracycline and linkomycine significantly increased (Saif et al., 2007; Ziv, 1981).

Use of tiamulin along with chlortetracycline (tetramotin) or tiamulin with doxycycline, increased their treatment effect, because of the synergistic effects (Kjan et al., 2006).

Antagonistic effect of tiamulin and some other ionophors like monensin, naracin and salinomycin should be concerned. Faghihi (1993) in his work showed the interaction and antagonism between tiamulin and some ionophores. Considering these results, it is obvious that the preventive and treatment levels of tiamulin and pulmotil for MG infection in both layers and broilers, influences the productive parameters like body weight gain, FCR, egg production and mortality. These results are fairly like that the results in Britain studies (Youxiang et al., 2008).

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