Dexamethasone Decreases Mortality Rate in Broiler Infected with Infectious Bronchitis Disease

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Abstract

To investigate the impact of dexamethazone (Dx) with or without spiramycin (Sp.) in controlling the mortality rate of broiler farms infected with infectious bronchitis (IB), two experiments were conducted. In the first pilot experiment, 750 broiler chicks (Ross) were divided into control (C) and two treated groups received Dx and Sp (G1) or only Sp (G2), respectively. Second experiment was conducted on five selected broiler farms (6000 chicks each), two farms were kept without treatment as a control, whereas other farms were treated with a combination of Dx and Sp. All birds were vaccinated against Newcastle disease (ND), avian influenza (AI), infectious bronchitis (IB) and infectious bursa disease (IBD), and monitored throughout the experiment to detect any respiratory sings. The treatment protocol was started when respiratory sings appear. Blood samples were collected at day 5 of treatment from jugular vein and serum was to assess aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) and to detect the antibody titer for the deferent vaccines by ELISA. The result showed significant decrease of mortality rate in G1 group among experimental groups and insignificant differences of liver function tests and immune response to the vaccination against ND and AI. It can be concluded that using a combination of dexamethasone and spiramycin has an efficient effect to protect broiler chicks against infectious bronchitis by decreasing the mortality rate with no immune suppression.

Key words: *Dexamethasone, spiramycin, broiler, infectious bronchitis, mortality rate.*

Introduction

Poultry is a fast growing field worldwide. In 1971 market share poultry meat is about 2-2.5%, which increase to 25% in 2010[1]. In spite of poultry growth throughout the world, various infectious pathogens influenced this sector of animal production like infectious bronchitis virus (IB)[2]. In chicks, IB virus is considered as an acute and highly contagious [3], where it causes a respiratory illness in chicks characterized by gasping, sneezing, tracheal rales, sinus inflammation, decrease body weight gain, puffy swollen eyes and coughing [4]. Many vaccine strains and various vaccination protocols are used to control this disease but the virus is difficult to control due to the absence of cross-protection among the different serotypes of the virus, so the failures of the vaccines is caused by antigenic variants that differ between vaccine strain and pathogenic strain, although the disease severity varies from flock to flock and place to place[5].

Although multiple types of virus strains have been used in the production of vaccines, such as 4/91, H120 and Ma5 strains, outbreaks still occur with high mortality rate in broilers with specific respiratory characteristic sings with or without neuropathogenic lesions[6]. [7] reported that 92.1% of samples collected from poultry flocks with severe respiratory signs in Iraq were infected with infectious bronchitis virus. Therefore, they concluded that there is a high prevalence of IB disease in Iraqi commercial broiler flocks. Morbidity of IB infection reach to 100%, while mortality rate range from 25-30

% but may reach to 80% depend on many factors related to host and/or virus and environment (immune status, strain, virulence, cold and heat and ammonia or dust) [8]. The post mortem changes in broilers show different types of exudate in trachea which started with serous to catarrhal and ended with caseous exudate that cause signs of neck stretching due to air passages obstruction[9,10]. Dexamethasone is a synthetic glucocorticoid with anti- inflammatory action. Its anti-inflammatory action is complex but primarily through inflammatory cells inhibition and suppression the mediators of inflammation, therefore, permeability of capillaries will decrease and increase lysosomal stability, while in lung it increase surfactant levels and pulmonary circulation improvement[11]. As a treatment, dexamethasone has a wide variety of uses in the medication field such as asthma and drug hypersensitivity reaction[12]. Spiramycin is a member of macrolide, firstly isolated from *Streptomyces ambofaciens* cultures. It is a broad spectrum antibiotic against gram-negative and gram-positive bacteria and also active against other organisms such as *Chlamydia trachomatis*, *Legionella pneumophila*, *Toxoplasma gondii* and *Mycoplasma pneumonia*. Spiramycin is also used as a growth promoter [13,14]. This study was conducted to investigate the impact of dexamethasone in control the mortality rate in broiler checks suffering from infectious bronchitis infection.

Materials and Methods

This experiment was carried out at the animal house of the College of Agriculture, Sumer University, Iraq and in five selected broiler farms in the surrounding region, throughout the period extended from February 25, 2020 to May 15, 2020.

Experimental design:

Seven hundred and fifty unsexed Rose chicks one day old were randomly allocated into three groups (250 per each) and were individually weighed. All chicks have been vaccinated against the most common diseases in the region (Newcastle, avian influenza, infectious bursal disease and infectious bronchitis; FATRO S.p.A Italy). This experiment was extended from February 25, 2020 to March 28, 2020. The selected region to perform this experiment was known as an area that affected by infectious bronchitis (IB), therefore, the chicks were monitored, throughout the experimental period, for any respiratory signs which could be appears that related to IB, such as dyspnea, asphyxia, runny nose, eye expansion with tears, increase mortality and postmortem lesion (bronchial bifurcation caseous plug, serous catarrhal or caseous exudate in the trachea, nasal passages and sinuses). When one or more of this signs are appear on the chicks, the protocol of the treatment started and extended for 5 consecutive days. Five days after the onset of respiratory sings, the diagnosis was confirmed by ELISA technique. Field experiment was carried out in a five selected broiler farms (6000 chicks per each) at Al-Refaae city, Thi-Qar province, Iraq. This experiment extended from April 10, 2020 to May 15, 2020. Food and water were supplied *ad-libitum*. Started diet was contain 23% protein and 3010 Kcal/kg and grower diet was contain 21% protein and 3100 kcal/kg. The diet composed from soybean, wheat, corn, minerals, multivitamin, methionine, Di-calcium-phosphate, choline chloride, vegetable oil and lysine. If any of the monitored signs are appear in a flock, the protocol of the treatment started and continued for 5 consecutive days. At day 5 of treatment blood was collected (from Jugular vein) and serum was separated to assess AST, ALT, and ALP (by spectrophotometric method) and antibody titer for different respiratory viruses (Newcastle; ND, Avian influenza; AI, and Infectious bronchitis; IB were assessed by ELISA technique.

Treatment protocol:

Dexamethasone (0.15 mg /kg) was used with or without spiramycin (200g/ 200L of drinking water, since each 500 g. contain 50 g. spiramycin adipate) to treat the secondary bacterial or mycoplasma infection according to the manufacturer (SAVCO. Syria). Chicks were divided into three groups as follow:

1. Control group: 250 chicks received drinking water only

2. Treated group1: 250 chicks received

dexamethasone and spiramycin in drinking water.

3. Treated group2: 250 chicks received spiramycin in drinking water.

In the second experiment the broiler farms were divided in to two groups, tow farm were considered as control and the other three farm were received the treatment when any respiratory sings were appeared.

Statistical Analysis

The results were expressed as mean ± SD. One way analysis of variance (ANOVA1) and Newman-Keule were used to compare between experimental groups for the first experiment, while in second experiment, t-test was used to compare between experimental groups. Difference at a level of $p<0.05$ was considered as significant. Statistical analysis was performed using the GraphPad Prism-version 5 (Graph Pad Software, Inc. California, USA).

Results

The result of the present study showed significant ($p\leq0.5$) increase in the mortality rate of control group compared to other groups of the experiment after two days of the appearance of respiratory signs (table 1), whereas the mortality rate of treated group decreased significantly ($p\leq0.5$) after two days of treatment. At the fifth day of treatment, treated group1 recorded the lowest rate of mortality ($p\leq0.5$) compared with other studied groups.

Table1: Effect of dexamethasone and spiramycin on mortality rate in broiler infected with infectious bronchitis.

Age	Groups		
	C	T1	T2
14 days	2 a	3 a	1 a
15 days	12 a	13 a	14 a
16 days	24 a	18 c	21 b
17 days	50 a	10 c	35 b
18 days	70 a	2 c	35 b

Different small letters denote significant difference ($p\leq0.05$)

The findings of the liver enzymes activities (shown in table 2) revealed insignificant ($p\geq0.5$) differences of AST, ALT, and ALP.

Table2: Effect of dexamethasone and spiramycin on the activity of liver enzymes.

Liver enzyme	**Groups**		
	C	**T1**	**T2**
AST	8.8 ±0.6 a	9.5 ±0.4 a	8.5 ±0.5 a
ALT	28 ±0.8 a	30 ±0.1 a	31 ±0.1 a
ALP	1670 ±13 a	1756 ±10 a	1692 ±15 a

Similar small letters denote insignificant difference ($p \geq 0.05$)

Antibody titers against ND, AI, and IB (table 3) after five days of the appearance of respiratory sings showed homogeneity of the samples values. The results of both ND and AI diseases recorded an acceptable standard deviation from the mean of the values, while the results of IB titers recorded highly variations among the values of samples with a large standard deviation.

Table3: Mean titer of broiler serum against ND, AI, and IB 5 days after the appearance of the respiratory sings.

Disease	Groups		
	C	T1	T2
ND	925 ±43.1	894.4 ±21.55	970.1 ±23.12
AI	1022.2±63.46	1016.3±39.71	1053.4 ±42.07
IB	6965.2± 5807.4	2290.6±2284.7	2108.2±1991.6

The finding of mortality number in the field (broiler farm), clarified in table (4), recorded significant ($p \leq 0.5$) increase of untreated farms, 2 days after the start of mortality elevation compared to that received the treatment.

Table 4: Effect of dexamethasone and spiramycin on mortality rate in broiler farms.

				Mortality NO.					
	Farm	**No. of chicks**	**age**	**d. 1 of treat.**	**d. 2 of treat.**	**d. 3 of treat.**	**d. 4 of treat.**	**d. 5 of treat.**	**Total mortality**
Treated Farms	**1**	6000	19	30	150	155	75	20	430
	2	6000	23	60	200	225	120	40	645
	3	6000	29	29	40	190	180	85	524
	Mean			39.66a	130 a	190 a	125 a	48.33a	1599 a
Non-treated farms	**4**	6000	15	50	250	443	612	850	2205
	5	6000	18	65	302	723	1040	1075	3205
	Mean			57.5 a	276 b	582 b	826 b	962.5b	2705 b

Different small letters (between the means of each columns) denote significant difference ($p \leq 0.05$)

Discussion

The finding of the present study recorded significant decrease in mortality rate in treated group compared to non-treated groups or farms. There is no available study on the effect of dexamethasone in animal model but our finding agreed with [15] whose reported that corticosteroid provided a therapeutic effect in COPD patients (chronic obstructive pulmonary disease) by inhibiting bronchoconstriction, promoting bronchodilation, suppressing the immune response and overall anti-inflammatory effect. World health organization[16], accept the trial results from United Kingdom which reported that dexamethasone can lifesaving for critically ill patients with COVID-19 (corona virus disease 2019).

Infectious bronchitis cause post mortem changes in broiler showed accumulation of different types of exudate in trachea which started with serous to catarrhal and ended with caseous exudate that cause signs of neck stretching due to air passages obstruction [9,10]. The effect of corticosteroid in the treatment of respiratory disorders had been explained by many researchers. [17] reported that corticosteroid reduce the levels of leukotrienes and therefore promote bronchodilation and relive airways obstruction. Systemic and injectable corticosteroids act in a similar way and their chief effects is reduction of airways inflammation by blocking the NFkB (nuclear factor kappa-light-chain-enhancer of activated B cells) pathway as well as reduction the expression of the enzyme phospholipase A2, which result in reduced synthesis of arachidonic acid and its metabolites[18]. By reducing transcription of IL-4 and IL-5, corticosteroid inhibit eosinophil recruitment and activation, furthermore, by blocking the synthesis of IL-3 mucus secretion is also reduced, which can further relieve airways obstruction[19].

The immune-suppression effect of dexamethasone is not clear in our finding, because the result of immune response to vaccines recorded insignificant different among the groups of the experiment. These finding is not agreed with[20] who reported that the induction of immunosuppression by dexamethasone in ducks result in progressively declining antibodies titers to very low levels which may make the birds susceptible to infection by challenge viruses, which lead to clinical disease and virus shedding. These differences in finding may be due to the time course of treatment.

Conclusion

According to present finding, dexamethasone can be used at a therapeutic dose to decrease the mortality rat in broiler infected with infectious bronchitis without harmful effect on immune response to vaccination program.

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Ethical Clearance: Not required

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