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Use of Bromhexine in the Management of Respiratory Diseases in Chickens

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Abstract:
Many respiratory diseases of chickens undergo airway contraction from edema, the formation of mucus, and cellular penetration. Based on the natural breath by breath system sometimes the normal amount of air may not flow easily. So the airways may vulnerable to failure. That leads to the common symptoms of the disease such as noisy breathing, cough, lethargy, and sneeze. Therefore, mucolytic drug therapy (bromhexine) is one of the options to increase the diameter of the airway that may mitigate or even eliminate these clinical signs. Hence the objective of this study is to review the literature regarding the use of bromhexine for the prevention and treatment of respiratory diseases.

Keywords: Respiratory diseases, chickens, mucus, disease symptoms, bromhexine.

INTRODUCTION

Within the increasing population of the world the demand for poultry protein is increasing day by day (Butt *et al.,* 2016; Hadyait *et al.,* 2018). Respiratory infections in poultry are the major group of diseases that cause significant economic losses to the poultry industry (Baksi *et al.,* 2017). Now a day the tremendous growth of the poultry industry makes it more susceptible to respiratory diseases (Ashraf *et al.,* 2019). So different chemical compounds in form of veterinary drugs with the object of preventing and treating animals including poultry birds from respiratory diseases have been used (Davidson *et al.,* 2008; Sumano and Gutierrez, 2008).

Self-defense mechanism against viruses and bacteria

In response to airborne disease agents, the poultry respiratory tract acts as a self-immune defense. There are three defensive mechanisms (cilia, mucus secretions, and scavenging cells) that protect poultry respiratory health. Cilia are hair-like structures in the trachea of poultry birds that are engaged in pushing the trapped particles. There are some goblet cells in the trachea that produce mucus. Mucus is composed of 95% water and 2% glycoprotein that is enriched in sialic acid (Cottel, 1995). The uniformity of the production of mucus in the trachea is vital for the better activity of cilia. At the submucosal level, the goblet cells produce more components of fluids along with a lesser concentration of glycoprotein (Bartoll, 2002). It has also been observed that the production of more viscosity of the mucus is due to bacterial or viral infection. Actually, in a common cold environment the rhinovirus, coronavirus, and adenovirus cause infection in the upper respiratory tract (Schellack and Labuschagne, 2014). And that the virus damages the ciliated cells that lead to the release of inflammatory mediators that causes the inflammation of linings of nasal tissues. Along with the increased permeability of capillary cell walls undergoes edema. Whereas the edema is responsible for coughing, sneezing, fever, sore throat, and congestion (Schellack and Labuschagne, 2014: National Prescribing Centre, 2017). But in recent studies, it has been known that bromhexine acts as an antioxidant and anti-inflammatory agent (Gibbs *et al.,* 1999) against rhinovirus, coronavirus, adenovirus, and many other bacteria. Whereas the scavenging cells in the lungs engulf the bacteria and inhaled particles. The air within unnecessary dusting produces the tracheal plugs that are unfavorable for the health of chickens. It has been noted that the production of ammonia from 10 to 40 ppm increased the excessive mucus that damage the cilia (Jacob and Pescatore, 2017).

Introduction of Bromhexine

To get rid of these respiratory diseases different mucolytic agents (bromhexine and ambroxol) are used in poultry farming. These bromhexine and ambroxol medicinal products were first time registered in European Union Member State in 1963 and 1978 respectively and recently used in European Union Member State (Debuf, 1991). Along with these mucolytic drugs (bromhexine, ambroxol, carbocysteine, and ethylenediamine) are abundantly used in poultry farming (Lizbeth *et al.,* 2016).

Bromhexine is a kind of cough related medicine having structural formula Br-CH2-CH2-CH2-CH2-CH2-CH3 (NCBI, 2019). Bromhexine and its metabolites such as ambroxol and cyclohexanol hydrochloride have been abundantly used in the poultry industry because of their mucolytic characteristics in the treatment of respiratory-related problems such as cystic fibrosis and chronic obstructive airway disease (Mestorino *et al.,* 2011). The mucolytic drugs are mostly used with the antibiotics for the treatment of respiratory diseases to increase the elimination of excessive persistent mucus (Debuf, 1991; Bottje *et al.,* 1998). So that the low viscosity mucus can easily be removed during coughing. Whereas Garst et al. (1991) stated that it is used to produce natural chemicals that

are engaged in the manufacturing of Bromo-cyclic compounds.

It is always preferable to use the drugs within the water. As the birds drink water at that time when the birds do not eat (Debuf, 1991). The advantage of the use of waterborne drugs is that these reduce the spread of disease by the contamination of water with the drugs (Clubb, 1984).

Absorption and the action mechanism of bromhexine in poultry

Oral supplementation of bromhexine is absorbed in the GIT (gastrointestinal tract) and it's wide metabolism is started in the liver. Just within one hour about 20% bromhexine from the liver is disseminated into the body tissues and attached to the plasma proteins (Reynolds, 2002). Whereas in lungs the bromhexine destroys the composition of acid mucopolysaccharide fibers and remove the mucus (thick liquid) by converting it into less thick liquid from the lungs. The remaining dose of about 85% to 90% bromhexine is removed through the urine (Lund, 1994; Morton *et al.,* 1999). However, the mechanism of action of bromhexine has been moderately investigated. Some of its actions have been examined that control the production of mucosubstances, sputum quality, and quantity, ciliary activity, diffusion of antibiotics and brutality, and regularity of cough. These characteristics discriminate it from other diseases (Alessandro *et al.,* 2017).

Effect of bromhexine on the antibiotic penetration

Bromhexine can be used for the cure of respiratory diseases in amalgamation with antimicrobial agents. It destroys the mucopolysaccharides of bronchial secretion and enhances the saturation of antimicrobial drugs (Mestorino *et al.,* 2011). These agents are currently used as a therapy for the destruction of pathogens. For example, in the case of alcoholic chronic pancreatitis where the viscosity of pancreatic juice is increased (Tscimoto *et al.,* 2004). Furthermore, bromhexine HCl increases the bronchial dissemination of antimicrobial drugs and thus interrupt the mucopolysaccharides of the bronchial secretions (Bergogne *et al.,* 1985). It has been described that the bromhexine hydrochloride enhanced the concentration of oxytetracycline in the secreted mucus (Bergogne, 1985; Martin *et al.,* 1993) and that it also starts the reverse reaction of mucolytic activity of oxytetracycline in vivo (Martin *et al.,* 1993). So it is possible to assume that bromhexine is a mucolytic agent that introduces changes in the tracheobronchial secretions. However further work on bromhexine is required for the treatment of respiratory diseases in poultry birds.

CONCLUSION

Although from previous studies the practical facts related to the poultry field indicate only reticent and positive results, it is not denotable that the efficiency of bromhexine is arguable. Bromhexine within a very minute occurrence of placid side effects is associated with positive perfection in the clearance of mucus from respiratory disease birds. There are inadequate facts in the literature to sustain the use of bromhexine for the prevention and treatment of these respiratory diseases. Bromhexine is currently used as a medicinal therapy for the removal of mucus produced by the infection of bacterial and viral pathogens.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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