A review of the role of five kinds of alternatives to in-feed antibiotics in broiler production

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In view of severe restriction of total ban on the use of antibiotics as growth promoters and therapeutic agents in poultry industry, the search for alternatives to replace antibiotics has gained increasing interest in animal nutrition. Gut micro flora appears to be the target for IFAs and alternatives to exert health benefits and some growth-promoting effects. Subsequent to banning of use of antibiotics as growth promoter in poultry nutrition, numerous studies turned to finding of alternative solutions, that is, other natural substances, which would have positive effect on chicken growth and feed conversion. Today, several groups of these additives are in use and most often probiotics, prebiotics, synbiotic, acidifiers and phytobiotics additives. Considering that each of the stated groups has its own specificities, the objective of this work was to present main mechanism of their action and to present their effect on production results in fattening of broiler chickens through review of research published in this field.

Key words: Broilers, probiotics, prebiotics, phytobiotics, synbiotic, acidifiers

INTRODUCTION

Growth promoters are chemical and biological substances which are added to livestock food with the aim to improve the growth of chickens in fattening, improve the utilization of food and in this way realize better production and financial results. Their mechanism of action varies. Positive effect can be expressed through better appetite, improved feed conversion, stimulation of the immune system and increased vitality, regulation of the intestinal micro-flora, etc. A probiotic is a live microbial feed supplement, which beneficially affects the host animal by improving its intestinal balance. It has been used as a substitute of antibiotics that is being used in considerable amounts as growth promoters in broilers production and is, associated with incalculable risks for human health resulting from the use of particular feed additives. Probiotics are one of the approaches that have a potential to reduce chances of infections in poultry and subsequent contamination of poultry products (Bellisle et al., 1998). Prebiotics are selectively fermented, dietary ingredients that result in specific changes in the composition and/or activity of the gastrointestinal microbiota, thus conferring benefit(s) upon host health (Zhan et al., 2003). Aromatic plants (phytobiotics) have been used since ancient times for their preservative and medicinal properties and to impart aroma and flavor to food. Hippocrates, the 'father of medicine', used plant extracts and prescribed perfume fumigations. For centuries, aromatic plants, also known as herbs and spices, their essential oils and herbal extracts have been used as natural pharmaceuticals in traditional medicine.

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and veterinary medicine. However, their use has not been based on rigorous scientific investigation, but has stemmed from ethno veterinary or even folkloric sources (Chang, 2000). The ban on the use of antimicrobial growth promoters within the EU (Barton, 1999) and the demand by consumers for safe products has renewed the interest in aromatic plants and their extracts mainly as a source of alternative therapeutics or natural antioxidants. Symbiotics is defined as a mixture of probiotics and prebiotics that beneficially affects the host by activating the metabolism of one or a limited number of health promoting bacteria and by selectively stimulating their growth, hence improving the hosts welfare (Collins and Gibson, 1999). Recent research showed that symbiotic products improved immune status in broiler chicks (Zhang et al., 2006). Organic acids are mixed with the feed to create an acidified pH which provides a favorable environment in the digestive tract of broilers for the effective digestion of dietary nutrients such as proteins. They act as growth promoters and feed preservatives in poultry where they can also maintain feed hygiene. Also organic acids improve protein and energy digestibility by reducing the microbial competition nutrients of the host, endogenous nitrogen losses and ammonia production are other beneficial effects for broilers (Dibner and Buttin, 2002). In any case, expected results of the use of these additives are increased financial effects of production. Because of the fact that growth promoters have different mechanisms of action, it is necessary to present every group individually and present the effect which can be expected with their utilization (Nahashon et al., 1996; Jin et al., 1998; Fuller, 1997).

PROBIOTICS

Probiotics are organisms and substances which help to improve the environment of the intestinal tract (Green and Sainbury, 2001). Certain species of bacteria, fungi and yeasts belong to group of probiotics. Existing probiotics can be classified into colonizing species (Lactobacillus sp., Enterococcus sp. and Streptococcus sp.) and free, non colonizing species (Bacillus and Saccharomyces cerevisiae) (Zikic et al., 2006). Lilley and Stillwell (1965) first introduced the term "Probiotic" to describe, "growth promoting factors" produced by microorganisms. The word "probiotic" is derived from the Greek word 'probios' meaning 'for life' and has had several different meanings over the years. Parker (1974) used the term probiotics for microorganisms or substances that contribute to intestinal microbial balance. Fuller (1989) redefined the probiotic as "A live microbial feed supplement, which beneficially affects the host animal by improving the intestinal microbial balance". As mentioned by Fuller (1992) and Anonymous (2002), several microorganisms have been used as probiotics, containing bacteria belonging to genus *Lactobacillus*; bacteria belonging to genus *Streptococcus*; yeasts belonging to genus *Saccharomyces*; yeast belonging to genus *Candida*; Moulds; *Bacillus subtilis* etc.

Probiotics display several ways of action: Antagonistic action towards pathogen bacteria by secretion of products which inhibit their development, such as bacteriocins, organic acids and hydrogen peroxide; the other way is competitive exclusion which represents competition for locations to adhere to the intestinal mucous membranes and in this way pathogen microorganisms are prevented from inhabiting the digestive tract, and the third way is competition for nutritious substances (Patterson and Brukholder, 2003). Vranesic (1992) reviewed the use of probiotics, live bacterial and or fungal cultures, as feed supplements and concluded that the probiotics stimulated numerous metabolic processes relating to feed digestion and absorption. It was also opined that few authors also include enzymes, yeasts and even organic acids in the group of probiotics. Hennig et al. (1993) evaluated the use of probiotics as growth promoters and opined that the experiments when supplemented with probiotics must end at a given weight. Palod and Singh (2004) indicated that the 'Probiotics' in broiler feeding was becoming a new area in biotechnology and offer a possible replacement for the use of sub-therapeutic level of antibiotics in broiler feeds. The probiotics include more than 200 species of bacteria and yeast. The various probiotics available in the market are either single or combination of bacteria, yeast and fungi. The use of probiotics in broiler feed causes better growth, higher feed conversion, better digestibility and improved product quality. The other results showed that adding primalse probiotics caused a decrease in the blood cholesterol, blood uric Acid and blood urea (Rezaei et al., 2013). Georgieva et al. (2000) observed a significant weight gain by less feed consumption at 49 days of age in broiler chicken when supplemented with a commercial probiotics, Lacto-Sacc compared to controls and antibiotic treated groups. Bhat et al. (2003) reported that the probiotic mixture containing *Lactobacillus sporogenes* 30,000 million cfu., *Lactobacillus acidophilus* 30,000 million cfu., *Sac. cerevisiae* SC – 47 1,25,000 million cfu., Alpha amyrase 5 gm and sea weed extract 50 gm/kg when fed to broiler chicken at the rate of 0.1% in feed improved the body weight gain, feed consumption and feed conversion ratio. Panda et al. (2000) reported probiotic had no influence on dressing percentage or weight of internal organs such as liver, heart and gizzard. According to Mandal et al. (1994) there was no significant increase in body weight gain in Biobooost®, a commercial probiotic containing *Sac. cerevisiae* and *Bacillus coagulans (L. sporogenes)*, supplemented group. They also reported serum biochemical components such as serum protein (5.70 ± 0.50 g/100 mL), serum calcium (9.00 ± 0.42 mg per 100 ml) and serum phosphorus (7.20 ± 0.42 mg/100 mL) which did not differ significantly.