

# Non-medicated growth promoters (NMGP'S)

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## INTRODUCTION

Antibiotics have been widely used in animal production for decades, since the early 50's, first primarily to control disease and more recently as antimicrobial growth performance promoters (AGPs) to improve growth rate and feed conversion efficiency. Facts: the industry has developed industrially thanks to the use of these products; besides, they have helped to reduce the famine in the world, and to make animal products more available to the consumer. However, there is a drawback: more and more bacteria resistant to antibiotics are being found every day; they are responsible for difficult to treat (if not fatal) infections. In year 2013, more than 30.000 people died from this kind of infections, a population similar to that of the city of Soria (Spain)



In order to decrease the spread of these resistances to antimicrobials, which are a big concern for consumers, there are different regulations being enforced in the European Union and USA, recommendations by the World Health Organisation and initiatives taken by the food chain, all pointing to a removal of the use of antibiotic feed additives, at subtherapeutical doses, for animal growth promotion

The removal of AGPs has lead to animal performance problems, and a rise in the incidence of certain animal diseases related with poor conditions of the small intestine; causing reduced digestibility and poor performance at the end. Consequently, together with the increased performance, nutrient immunomodulation and maintenance of normal gut flora in broilers are important considerations to take into account in the search of alternatives to AGPs. Thus, recent focus for alternative strategies has been to prevent proliferation of pathogenic bacteria and modulation of indigenous bacteria so that the health, immune status and performance are improved

Essentially, the main way in which the industry can reduce its dependence on antibiotic use in animals is the development of alternatives to antibiotics that work via similar mechanisms, promoting growth whilst enhancing the efficiency of feed conversion. However, the mode of action of AGPs is not yet fully understood. Different potential mechanisms have been proposed to explain AGP-mediated growth enhancement. The most accepted mechanism would be through modulation of the gut microbiota, which plays a critical role in maintaining the host health. Microbiota composition influences the intestinal environment and the development and responses of the host immune system against pathogenic and non-pathogenic antigens.

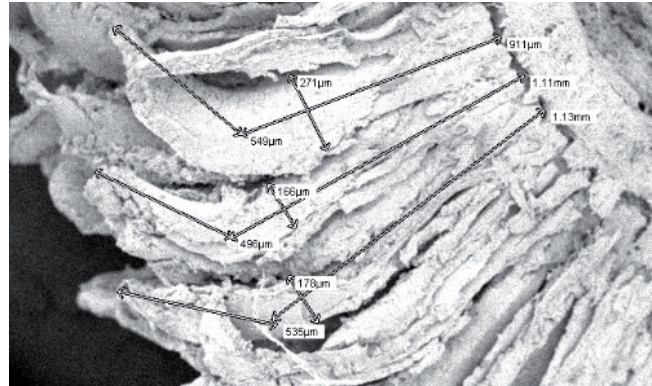
So far, the focus of alternative strategies has been to prevent proliferation of pathogenic bacteria and modulation of indigenous bacteria so that the health, immune status and performance are improved. However, it may well be necessary to adopt changes in the management of livestock and also introduce different feed components in order to compensate for the antibiotics effects and maximize production. Genetic improvements in animals and vaccinations may also be useful. Therefore, some of the alternatives described below may be part of the solution even though they do not reproduce all the beneficial effects of antibiotics



## Organic Acids

Organic acids are not antibiotics but, if used correctly along with nutritional, management and biosecurity measures, they can be a powerful tool in maintaining the health of the GI tract of poultry, thus improving their zootechnical performances. Due to their antimicrobial effect, organic acids result in inhibition of intestinal bacteria leading to the reduced bacterial competition with the host for available nutrients and diminution in the level of toxic bacterial metabolites. As a result of the decreased bacterial fermentation, protein and energy digestibility might be improved and thereby ameliorate the performance of bird. For example, Gunal et al. (2006) found that both a mixture of propionic and formic acid salts and the inclusion of flavomycin significantly decreased total bacterial and gram negative bacterial counts compared to the basal diet

Organic acids also have demonstrated to increase villus height in the small intestines which increases the absorptive intestinal surface and might facilitate the nutrient absorption and growth performance. Maiorka reported that a mixture of fumaric, lactic, citric and ascorbic acids, as a substitutive of AGPs improved performance of broilers even in absence of antibiotic. Sodium butyrate has demonstrated to control pathogenic bacteria, increase diet digestibility and improve animal performance. Chamba demonstrated that the addition of protected sodium butyrate to the diet improved animal performance when compared with colistine or a control (blank) group, because of a better villi development in the intestine. He concluded that it is a possible substitute to AGPs



2009 Butiric acid-based feed additives help protect broiler chickens from *Salmonella enteritidis* infection. C. Fernández-Rubio, C. Ordóñez, J. Abad-González, A. García-Gallego, P. Honrubia, J.J. Mallo and R. Balaña-Fouce. *Poultry Science*. 88:943-948

## Enzymes

Enzymes are routinely added to poultry feeds in order to facilitate the breaking down of certain components of the feed, such as -glucans, proteins and phytates, that the animals may have problems digesting. Current research is focused on improving the quality of existing enzymes, whilst broadening the range of feed ingredients that they may be used to digest

## Herbs, phytogetic additives

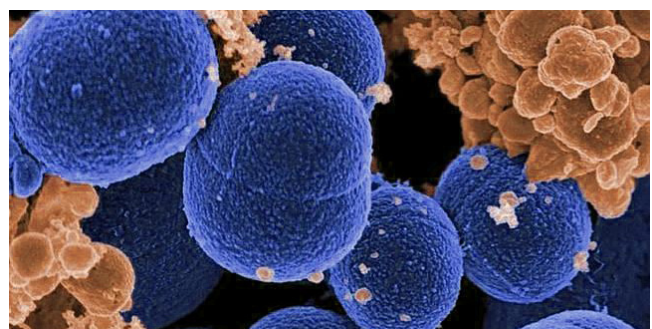
Biologically active constituents of plants are mostly secondary metabolites, such as terpenoids, phenolics (tannins) glycosides and alkaloids. The challenge is to identify and quantify the multitude actions and claims improving feed utilisation, animal physiology and health status. Mechanism of the action of these additives is not completely clear. Some plant extracts influence digestion and secretion of digestive enzymes and, besides, they exhibit antibacterial, antiviral and antioxidant activities



Ziaie reported that the supplementation with both a commercial mixture of medicinal plants or virginiamycin improved body weight, average daily gain, and feed: gain ratio of broilers when compared to a control diet. Yazdi suggested that dietary inclusion of anise seed can be used as alternative to in-feed antibiotics for broiler diets with improvement in feed conversion and increased antibody titer against avian influenza virus increased in the group compared to a control supplemented with flavophospholipol

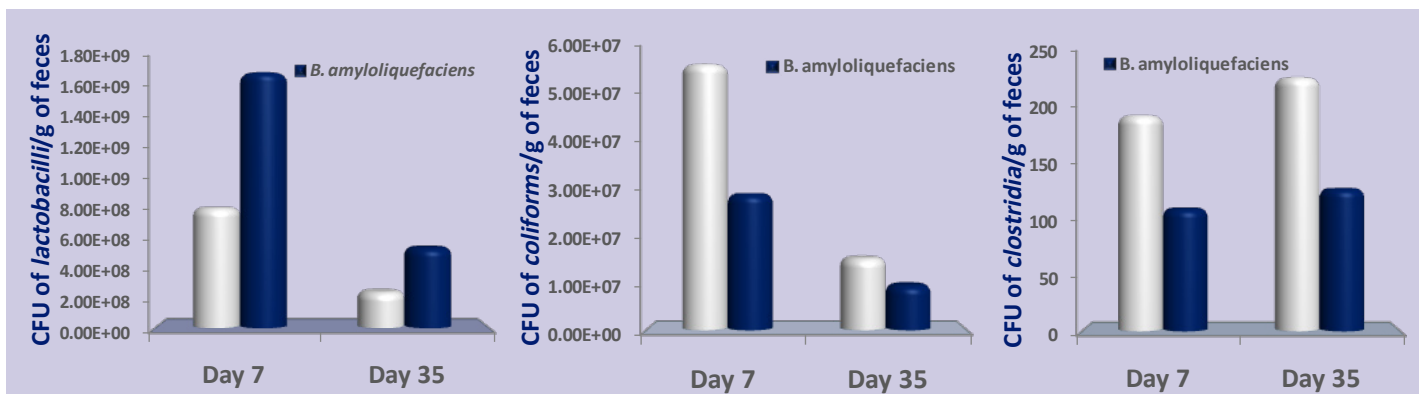
## Probiotics

Probiotics are individual microorganisms or groups of microorganisms which have favourable effect on host by improving the characteristics of intestinal micro-flora and thus, health and growth. Unlike antibiotics, probiotics introduce live beneficial bacteria into the intestinal tracts. Several authors have assessed the efficacy of probiotics as growth promoters. Most concluded that when results are averaged over several trials, there is an improvement in growth rate and in the efficacy of feed utilization



Probiotics are similar to competitive exclusion products. They are believed to improve the overall health of an animal by improving the microbial balance in its gut. The way in which they work has not been established, although it has been hypothesized that their action can be summarised in three ways. Competitive exclusion: by colonizing the gut in large numbers, the probiotic bacteria compete for locations to adhere to the intestinal mucous membranes, exclude pathogens and thus prevent them from causing infection. Stimulus for the immune system: as the immune system is engaged following exposure to probiotic bacteria, any hostile bacteria is also noticed, following increased surveillance by leukocytes, and thus potential pathogens are eliminated. Influencing intestinal metabolic activities, such as increased production of vitamin B12, bacteriocins, organic acids and other compounds that have antagonistic action towards pathogen bacteria. Other mechanisms have been proposed but remain to be confirmed

According to Denev (2008), the addition of a commercial probiotic significantly increased the number of *Lactobacilli* and *Enterococci* in the caecum of broiler chickens and reduced the caecal coliform population. There were no significant differences observed in the number of *Lactobacilli*, *Enterococci* and coliforms present in the caecum of the untreated control, flavomycin and avilamycin-fed groups. The probiotic increased the body weight of broilers compared with the other treatments and both probiotic and antimicrobials improved feed efficiency compared to the untreated control. Additionally, the three supplements reduced the faecal number of obligate anaerobes, *E. coli*, *Enterococcus* and *Clostridium* spp. in comparison to the untreated control



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Probiotics composed of sporulated bacteria can also be as effective as antibiotics. Gutiérrez found that animals fed a probiotic based on *B. amyloliquefaciens* outperformed animals from a control group, with similar results to a zinc bacitracin group. Both the AGP and the probiotic improved feed digestibility, and besides, the probiotic animals had higher populations of *lactobacilli* and lower populations of *E. coli* in the ileum. Elmaliah published in a similar study that the combination of zinc bacitracin and a *B. amyloliquefaciens* probiotic had synergistic effects. Feed Conversion Ratio was further improved (when compared with the AGP alone and the control), and the animals presented higher yields at slaughterhouse

## CONCLUSIONS

Consumer demands and legislative pressure on the withdrawal of antibiotics from poultry foods have created the need for alternative solutions which would influence improvement of health and production traits of broiler chickens. To be effective, alternatives for AGPs should generate similar benefits as the antibiotics currently used as growth promoters. Enzymes, organic acids salts, probiotics and phytogenic additives are some examples of product classes which are used as alternatives for AGPs. However, within each product class, numerous products are on the market, and while some products clearly have potential, for others the efficacy is not clear. Even, it may be necessary to combine two or more alternative feed ingredients or to combine a new feed supplement with a change in husbandry practices to achieve the best effects. Further research is also needed to find the mechanisms of the action of these compounds and their interaction with other factors of production to set and meet standards for AGPs alternatives for broilers.

If you need further information, do not hesitate to contact the author:



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