Ohly Application Note

Benefits of Application of Yeast β-Glucans in Poultry

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Abstract: The well-known immune modulating effects of yeast β-glucans in humans have also been demonstrated in poultry. Dietary supplementation with yeast β-glucans improves animal productivity with respect to daily body weight gain and feed conversion ratio, and reduces mortality. Moreover, they result in a reduction of bacterial infections and an increase of antibody titers after vaccination. Consequently, yeast β-glucans provide a valuable tool to the poultry producer as an alternative to antibiotics.

Keywords: Yeast beta glucan, Poultry, Antibiotic replacement

Introduction

Bacterial infections are an important problem for both poultry health and productivity. Traditionally, antibiotics were used sub-therapeutically by the poultry industry to reduce the impact of bacterial infections. However, there are increasing consumer concerns about drug residues in meat products and the rise of antibiotic resistance of pathogenic bacteria (Gadde *et al*., 2017). As a result, many countries have banned the inclusion of antibiotics in poultry diets as a routine means of growth promotion. Consequently, there is an increasing demand for alternatives to antibiotics.

Beta-glucans are naturally occurring polysaccharides with well-known health benefits. They are abundantly present in the cell walls of many micro-organisms and cereals. There are different types of β-glucans. Beta-glucans from yeast and fungi, so called β-(1→3)(1→6)-β-glucans, have been shown to have beneficial effects as supplements (Zhu *et al*., 2016). In contrast, β-glucans from cereals with a different structural composition, (β (1→3)(1→4)-β-glucans), have very detrimental effects on poultry health and performance (Jacob and Pescatore, 2014).

Amongst β-glucans from microbial sources, those from the yeast *Saccharomyces cerevisiae* have been found to be the most active (Raa, 2015). After decades of studies, the health benefits of yeast β-glucans have in the meantime been well established in humans (Zhu *et al*., 2016; Raa, 2015). An increasing body of evidence demonstrates

similar benefits in poultry (Jacob and Pescatore, 2017).

Increasing Resistance against Pathogens

The immune system is the host defense system that protects it against diseases. Yeast β-glucans play an important role in the activation of both innate and adaptive immune systems. They activate macrophages, a key component of the non-specific (innate) immune system. Also in broiler chickens, dietary supplementation with yeast β-glucans has been shown to increase the macrophage phagocytic activity (Guo *et al*., 2013; Lowry *et al*., 2005). Moreover, yeast β-glucan supplementation of the broiler chicken diet also results in larger lymphoid organs (Guo *et al*., 2013), the organs that produce lymphocytes. Lymphocytes are the common precursor cells for both the adaptive immune system as well as for natural killer cells, involved in defending the host against virus infections.

Boosting the Immune System of Neonate Chickens

Young chickens have an immature immune system. Therefore, the first days after hatching, chickens are highly susceptible to infections by opportunistic pathogens. Lowry *et al*. (2005) have demonstrated that yeast β-glucan supplementation of the diet of young chickens challenged with *Salmonella*, resulted in a significant protection against this pathogen.

Reducing Food Poisoning by *Salmonella*

Salmonella is one of the four key global causes of diarrheal diseases, and results annually in over 250 000 human deaths (GBD, 2016). Poultry is a common source of *Salmonella*. Yeast β-glucan fed broiler chickens showed a reduction in the *Salmonella* counts of different internal organs (Shao *et al*., 2016; Revolledo *et al*., 2009; Lowry *et al*., 2005), indicating the potential of yeast β-glucan in the prevention or reduction of food-borne *Salmonella* infections.

Increasing Antibody Titers after Vaccination

Poultry vaccines are an important component of poultry disease prevention and control. Yeast β-glucans are long known to be adjuvants, boosting the response of the adaptive immune system after vaccination (Jin *et al*., 2018). Also in poultry, it has been demonstrated that yeast β- glucans increase antibody titers with some 60-80% after vaccination of broiler chickens by New Castle disease Virus and Infectious Bronchitis Virus (An *et al*., 2008).

Boosting Animal Performance

Bacterial infections are not only an important concern for animal health, but also for animal productivity. Supplementation of broiler diets with yeast β-glucans has been demonstrated to improve growth performance. Improvements of up to 10% in average daily gain (i.e. Zhang *et al*., 2008; Shao *et al*., 2008; An *et al.*, 2008; Tian *et al*., 2016; Chae *et al*., 2006; Huff *et al.*, 2006) as well as up to 6% in feed conversion ratio (i.e. Zhang *et al*., 2008; An *et al.*, 2008; Tian *et al*., 2016; Chae *et al*., 2006; Huff *et al.*, 2006) have been reported in different poultry trials. The animal performance benefits of yeast β-glucans were especially pronounced when the flocks were raised under 'dirty' or challenged trial conditions, resulting in lower mortalities (Tian *et al*., 2016; Huff *et al.*, 2006).

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