

Benefits of Application of Yeast β -Glucans in Pigs

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Abstract: The well-known immune modulating effects of yeast β -glucans in mammals have also been demonstrated in pigs. 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 pig producer as an alternative to antibiotics.

Keywords: Yeast beta glucan, Pigs, Antibiotic replacement

Introduction

Bacterial infections are an important problem for both pig health and productivity. Traditionally, antibiotics were used sub-therapeutically by the pig 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. 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 (Liu *et al.*, 2018).

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 \rightarrow 3)(1 \rightarrow 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 \rightarrow 3)(1 \rightarrow 4)- β -glucans), decreased production efficiency by reducing nutrient digestibility especially in young pigs (Metzler-Zebeli and Zebeli, 2013).

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 pigs (Vetvicka *et al.*, 2014).

Immune Modulation: 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 pigs, dietary supplementation with yeast β -glucans has been shown to activate macrophages and neutrophils (Beart *et al.*, 2015; Vetvicka and Oliviera, 2014). Moreover, yeast β -glucan supplementation of the diets of weaned piglets also results in the proliferation of lymphocytes, the precursor cells of the adaptive immune system (Wang *et al.*, 2008).

Boosting the Immune System of Young Pigs

Newborn piglets have an immature immune system. Therefore, in the pre-weaning period piglets are highly susceptible to infections by pathogens. For instance, Chethan *et al.* (2017) have demonstrated that yeast β -glucan supplementation of the diet of young piglets with a confirmed rotavirus infection, resulted in a significant protection against this pathogen.

Reducing ETEC borne Diarrhea

Enterotoxigenic *Escherichia coli* (ETEC) is one of the most important causes of diarrhea in neonatal, suckling and newly weaned piglets. ETEC causes significant morbidity and mortality resulting in large economic losses in the porcine industry. Yeast β -glucan fed weaned piglets were

less susceptible to ETEC infections and, moreover, in case diarrhea did occur, it was less severe (Stuyven *et al.*, 2009, Zhou *et al.*, 2013).

Increasing Antibody Titers after Vaccination

Pig vaccines are an important component of pig 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 pigs it has been demonstrated that yeast β -glucans increased antibody titers significantly after vaccination, as i.e. reported by Wang *et al.* (2008) when vaccinating against classical swine fever virus.

Boosting Animal Performance

Bacterial infections are not only an important concern for animal health, but also for animal productivity. Supplementation of pig diets with yeast β -glucans has been demonstrated to improve growth performance. Improvements of up to 14% in average daily gain (i.e. Wu *et al.*, 2018; Vetvicka and Oliviera, 2014; Hahn *et al.*, 2006; Szuba-Trznadel *et al.*, 2014; Li *et al.*, 2006; Zhou *et al.*, 2013; Wang *et al.*, 2008) as well as up to 14% in feed conversion ratio (i.e. Szuba-Trznadel *et al.*, 2014; Li *et al.*, 2006; Zhou *et al.*, 2013; Wang *et al.*, 2008) have been reported in different pig trials. The animal performance benefits of yeast β -glucans were especially pronounced when the pigs were raised under 'dirty' or challenged trial conditions, also resulting in lower mortalities (Szuba-Trznadel *et al.*, 2014).

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