Ohly Application Note

Benefits of Application of Yeast Cell Walls in Animal Husbandry

By Dina Krüger and Mariët van der Werf*

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***Corresponding Author:**
Dr. ir. Mariët van der Werf
Global Platform Director - Feed Health

Ohly GmbH:
Wandsbeker Zollstrasse 59,
D-22041 Hamburg
Germany
Tel: +49 40 68 293 0
Email: info@ohly.com

Abstract: Yeast cell walls, commonly referred to as MOS, are widely used by the animal feed industry. Yeast cell walls are natural feed additives rich in two functional polysaccharides with health improving properties: mannan oligosaccharides (MOS) and β-glucan. Some 1000 scientific papers have been published about the benefits of yeast cell walls in animals. Statistical meta-analysis of the results of these studies have substantiated the well-accepted benefits of yeast cell walls to improve animal health and performance.

Keywords: Yeast cell wall, MOS, β-Glucan, Poultry, Pigs, Calves, Statistical meta-analysis, Antibiotic Replacement

Introduction

Yeast cell walls, commonly referred to as MOS, are widely used by the animal feed industry to improve animal health and performance. Historically, yeast cell walls were added to animal feed because of their protein content (20-30%). However, with the expanding body of evidence about their health benefits, they are increasingly being applied as natural antibiotic replacers.

Antibiotics have traditionally been used in the husbandry of livestock to reduce the impact of bacterial infections but also to improve animal performance. However, due to increasing concerns about rise of antibiotic resistance in human health, many countries have banned the prophylactic use of antibiotic growth promoters (AGP) in animal feed (Gadde *et al*., 2017). This resulted in a decrease in animal performances and a rise in the incidence of illnesses associated with *Clostridium perfringens*, *Salmonella* or *Escherichia coli,* etc. Consequently, there is a large demand for alternatives to antibiotics (Gadde *et al*., 2017).

Given the health benefits of yeast cell walls, they are currently one of the most important natural feed additives that are widely used as antibiotic replacers (Spring, *et al*., 2015; Credence Research, 2018).

Yeast cell walls are rich in two natural functional polysaccharides with well-

accepted health improving properties: mannan oligosaccharides (MOS) and (1,3)(1,6)-β-D-glucan. MOS, present on the outer layer of autolyzed yeast cell walls (van der Werf, 2019), bind pathogenic bacteria thereby inhibiting their colonization of the gut and thus preventing infections or the release of toxins (Kwiatkowski and Kwiatkowski, 2012; Fowler *et al*., 2015). MOS also enhance gut health by improving the functional structure of the intestines (Ganner 2012).

Yeast β-glucans have well known immune modulating properties improving the innate but also the adaptive immune responses. (Goodridge *et al*., 2009; Jin *et al*., 2018). Consequently, β-glucans improve the resistance of livestock against microbial infections. Moreover, β-glucans are known to bind mycotoxins (Piotrowska and Masek, 2015) facilitating the decontamination of mycotoxin containing feed.

Some 1000 scientific papers have been published that have reported on the effects of yeast cell walls in husbandry and aquaculture. These studies have clearly demonstrated the health and performance benefits of yeast cell walls both in animal trials as well as in more mechanistic, molecular biological studies (Spring *et al*., 2015).

Given the large number of scientific studies performed with yeast cell walls in in poultry, pig, ruminants and fish (a.o. Spring *et al*., 2015; Zhiwei, 2016), several authors have executed statistical meta-analysis to establish the quantitative benefits of yeast cell walls. These analyses conclude unequivocally the statistical significant benefits of yeast cell walls on animal health and performance.

Benefits of supplementing yeast cell walls to poultry feed

Numerous studies have clearly demonstrated that birds fed diets supplemented with yeast cell walls had a significantly improved body weight gain and feed conversion ratio (FCR) and lower mortality rates even reaching improvements similar to birds receiving AGP (Hooge, 2004a, 2004b; Hooge *et al*., 2013; Spring *et al*., 2015).

i. Broiler chicken

Different statistical meta-analyses studies summarizing over 100 trials in which yeast cell walls were fed to broilers, have reported on various performance improvements (Hooge 2004a; Hooge *et al*., 2013; Rosen, 2007a). Broilers fed a diet containing yeast cell walls had

- 2.0% - 3.4% higher body weights
- 2.3% improvement in FCR
- 22% lower mortality

ii. Turkey

Studies in which turkeys' diets were supplemented with yeast cell walls have also shown significant performance improvements (Hooge, 2004b; Rosen, 2007b). Statistical meta-analysis of the results of animal trials performed in a period of 10 years (Hooge, 2004b; Rosen, 2007b), have reported that yeast cell wall fed turkeys showed:

- 2.3% higher body weight
- 1.6% improvement in FCR
- 25% lower mortality

Benefits of application of yeast cell walls in pigs

i. Weaning piglets

Weaning piglets from the sow is the most stressful event in a piglet's life. It results in intestinal and immune system impairments contributing to reduced pig health, growth and feed intake during the first weeks post-weaning (Bontempo *et al*., 2006; Campbell *et al*., 2013).

Multiple studies have shown that feeding nursery piglets yeast cell walls immediately after weaning, improves their

performance, resulting in enhanced growth rate, feed intake and feed efficiency (Miguel *et al*., 2004; Rosen 2006; Halas & Nochta, 2012).

Statistical meta-analysis of over 10 years of animal trials (Rosen, 2006; Spring *et al*., 2015) revealed that pigs fed a diet supplemented with yeast cell walls exhibited:

- 3.6% improvement in body weight
- 1% improvement in feed intake
- 3% improvement in FCR

ii. Sows

Moreover, a review study of various sow trials has revealed that feeding sows yeast cell walls also resulted in several benefits (Taylor-Pickard, 2015) such as:

- Increased litter size by 0.32 piglets
- Improved quality and production of colostrum
- Improved piglet growth in the first 24h of life
- Reduced weaning to breeding (wean-oestrus) period, meaning more litters born per sow.

A techno-economical analysis, based on 12 studies, has shown that supplementing pig diets with yeast cell walls results in a significant economical benefit, with a return on investment of 7.4:1, roughly a net return of USD 42/sow/year (Taylor-Pickard, 2015).

Benefits of supplementing yeast cell walls to milk replacers for calves

In the early stages of a calves live, it encounters a number of stressors such as weaning, castration, vaccination and transportation that negatively affect their health and performance (Arthington *et al*., 2008). Diarrhea is a major issue in young animals and one of the main causes of death. Yeast cell walls added to milk or milk replacer was found to be as effective as antibiotics in improving fecal scores (Heinrichs *et al*., 2003), and significantly reduced fecal pathogen (*E. coli* or *Cryptosporidium spp*) counts (Spring *et al*., 2015).

Statistical meta-analyses of trials in which yeast cell walls were added to milk or milk replacer fed to calves (Berge, 2016; Hooge, 2006) have revealed that yeast cell walls provide several benefits to the calves' performance, including:

- 15% higher total body weight of calves weaned at 2 months
- 10% increase in daily weight gain
- 15% improved starter feed intake

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