Supporting the innate immune system – a new yeast cell wall product

The animal production industry is under increasing pressure to look after ways and means to produce animal protein in the most sustainable and cost-effective manner in order to provide healthy food for today and the generations to come. This is without any doubt the way forward but we also need to look into the past in order to achieve this commonly shared goal.

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In 1920, a French microbiologist by the name of Henri Boulard was travelling through Southeast Asia in search of a heat-stable yeast that was suitable for wine production.

During his journey he observed that the local people suffering from infectious diarrhoea caused by cholera were chewing the skins of lychee and mangosteen or were drinking tea made with the same.

As he made this observation more often and saw people recovering he became interested in the composition of these tropical fruits.

After returning to France he continued his research and was finally able to isolate a new strain of yeast from these tropical fruits and, in 1923, Saccharomyces cerevisiae var. boulardii was introduced to the world.

Over the years, S. boulardii has been extensively studied and well characterised. Although S. boulardii is genetically more or less identical to S. cerevisiae, a common brewer's yeast, it shows clear differences in terms of optimal growth temperature (37°C vs. 30°C) and acid resistance (pH 2.0 vs. 6.0) which allows a much more targeted application.

Several trials and experimental studies reported anti-toxin, antimicrobial, anti-inflammatory and immunomodulatory effect of S. boulardii and this strongly suggests a place for S. boulardii as a biotherapeutic agent for the prevention and treatment of several gastrointestinal diseases.

Today, S. boulardii supplements can be easily found in pharmacies and drugstores as one of the most approved probiotics for digestive disorders in humans.

S. boulardii, a yeast cell wall product

S. boulardii is also an effective supplement for poultry as much as it is used for human application. Its natural ability to survive and grow in the gastrointestinal tract has led to its development as a feed additive which supports the innate immune system. While there are many positive elements with this approach, there is one which is limiting that S. boulardii could become fully active and perform its stimulation functions.

When using a live yeast product, one cannot fully expect its immunomodulatory effect. This is due to the fact that the branched β-1,3-1,6-glucans are located in the inner layer of yeast cell walls.

As only these specific glucan structures are recognised by pattern recognition receptors (PRRs) of macrophages, stimulating phagocytosis and immunoglobulin secretion they need to be liberated in order to become active. The inner layer of yeast cell wall with its embedded β–glucans has therefore to be leveraged in order that they could show their boosting effects on the host immune system.

In this context it has to be mentioned that S. boulardii has a thicker inner cell wall resulting in more enriched β-1,3-1,6-glucan content compared to S. cerevisiae.

Also, the composition and structure of its functional polysaccharides is more complex allowing improved immunomodulatory abilities compared to S. cerevisiae.

This implies that S. boulardii is a superior yeast cell wall product and a more promising one to support the innate immune system of chickens.

Practical application in the feed industry

Today it is still difficult to find a feed additive based on S. boulardii. The reasoning is that most of the yeast products available to the feed-producing industry today are by-products from the alcohol, food and biofuel producing industries. In other words these processes need to fulfill other requirements like, for example, producing alcohol and here S. cerevisiae is outperforming S. boulardii.

A new strain of yeast was isolated from the exotic mangosteen fruit.

This fact is the simple reason why yeast products derived from S. cerevisiae could easily be found in the market but such products are less active as an innate immunity stimulating agent compared to products derived from S. boulardii.

But even if an S. boulardii derived feed additive could be found, special attention has to be given to the extraction method as it will greatly affect the quality as a feed additive.

Pathway Intermediates has developed a process during which the branched β-1,3-1,6-glucans located in the inner part of the yeast cells walls are gently liberated without damaging other valuable components of S. boulardii. Here in particular the mannan-oligosaccharides have to be mentioned, which are well known for their ability to bind pathogenic bacteria preventing them from attaching to the gut wall.

The ideal yeast cell wall product

Pathway Intermediates, with its main subsidiaries in the UK and South Korea, is the feed additive branch of the South Korean agribusiness company Easy Bio. Dedicated

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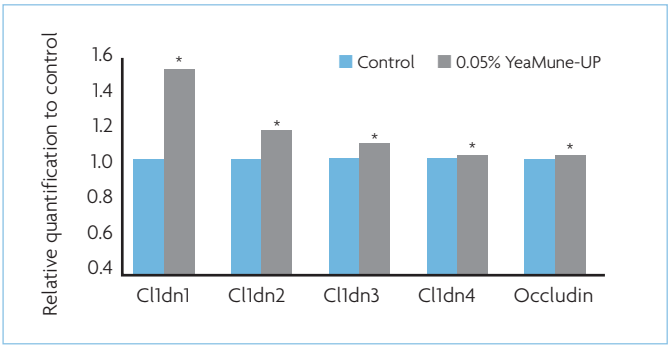

Fig. 1. Supplementation of 0.05% YeaMune-UP in a broiler diet. Tight junction protein gene expression were significantly increased (P<0.05).

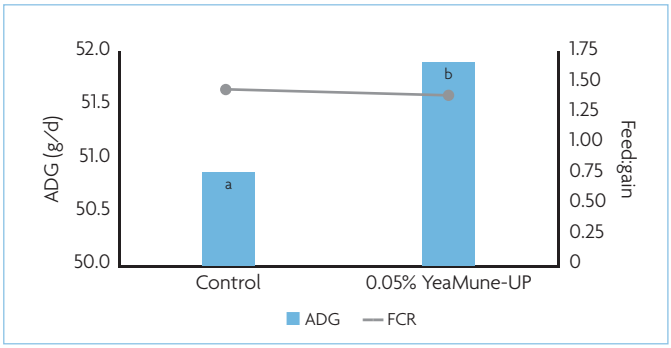

Fig. 2. Supplementation of 0.05% YeaMune-UP in broiler diets. Body weight gain was improved without affecting feed efficiency ([a,b] P<0.05).

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research is one of the major pillars of Pathway Intermediates and the company has been steadily expanding its portfolio into products improving the absorption of nutrients and aspects related to gut health.

With more than 30 years of experience in fermentation, Pathway Intermediates manufactures a one-of-a-kind yeast cell wall product (YeaMune-UP) through a special and dedicated process with a patented strain of S. boulardii.

The production process of this special yeast cell wall product has been solely developed for the intended purpose making the product unique and outstanding as it is not a by- nor a co-product. YeaMune-UP is available in Asia and the USA and has recently been launched in Europe.

Recent trials with broilers clearly demonstrated its efficacy in supporting the innate immunity of poultry and performance improvement.

For example in one trial, YeaMune-UP supplementation significantly increased tight junction protein gene expression (claudin family, occludin) (Fig. 1).

Tight junctions are cell to cell adhesion complexes which play a major role in gut health.

Consequently, due to better gut health as indicated by tight junction protein status, body weight gain was improved by 3.8% and 2.0% for broilers, respectively, without affecting feed efficiency (Fig. 2).

Young animals in particular are often seen as having an immature immune and digestive system.

Thus their fragility is all too often realised when they are not supported both nutritionally and immunologically.

To provide this support we could benefit from yeast cell wall products but care has to be taken about the kind of yeast used and the processes applied afterwards in order to liberate and maintain beneficial components for the animal and the expected return on investment. ■