The importance of nucleotides in gut development

The growth period of broiler chickens is short, so management, nutrition, and sanitation errors can have a direct impact, causing economic losses, as there is no time for the birds' performance to recover from these mistakes. Therefore, it is very important to invest in the early life of the bird, providing conditions that allow it to express its maximum genetic potential.

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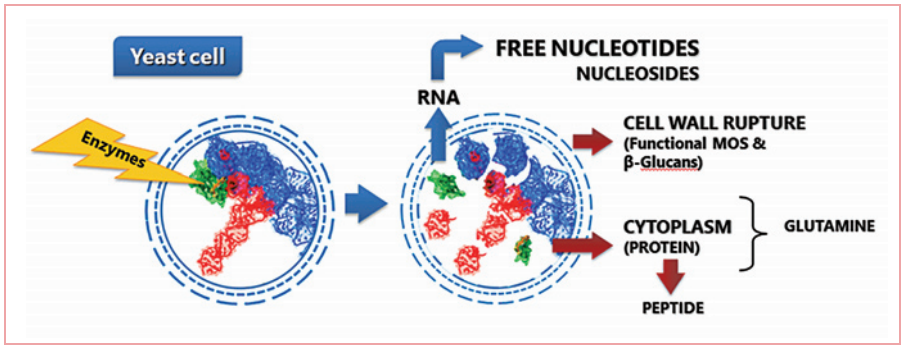

Fig. 1. Hilyses components.

With the restrictions surrounding antibiotics as growth promoters, potential challenges have been more evident, such as sanitary problems (cleaning and disinfection, water quality, etc); problems with vaccination (application, periods, dosage, etc); nutrition (ingredients of poor quality or variation thereof, mycotoxins, nutritional imbalance, among others); reduction of passive immunity (maternal antibodies); management, among other factors. Thus, a strict health plan and proper nutrition are indispensable, especially for the newly housed chick.

Approximately a quarter of the intestinal mucosa of a bird is composed of lymphoid tissue and more than 70% of these are cells of the immune system, which include unorganised or dispersed cells (lamina propria, leukocytes, and intraepithelial lymphocytes), as well as the highly organised lymphoid follicles (Peyer's plaques, where IgA and B lymphocytes are generated).

Gut-associated lymphoid tissue (GALT) is the major component of mucosal-associated lymphoid tissue (MALT) and a significant source of immune cells that monitor and protect the lining of the intestinal mucosa. GALT is continuously exposed to food antigens, microbiota, and pathogens. The maturation of the immune system of birds occurs primarily by the cells of the innate immune system, where about three days after hatching the presence of macrophages is detected in an amount that does not change much with the development of the bird. B lymphocytes (produced and differentiated in the bursa of Fabricius), which will differentiate into antibodies and are responsible for the specific immune response, show a low level that increases dramatically after three weeks of hatching.

It is important to note that maturation of the digestive system (especially enzyme production) is also occurring in the first three weeks of life. Therefore, providing the best possible conditions for this onset of growth/development is important, since the environmental and dietary challenges will determine the balance between immune cost and performance.

The use of functional nutrients/additives has grown and is due not only to the need to replace growth-promoting antibiotics, but because new concepts are increasingly being studied, understood and accepted.

Nucleotide supplementation through the diet has been studied in several species and although they are not considered essential nutrients, they play an important role in several metabolic processes and in some body tissues and stages of animal life in particular.

Nucleotides and free nucleosides can be immediately absorbed by enterocytes in the gut and are especially important in tissues of rapid cell multiplication and limited capacity for synthesis by via de novo (main nucleotide production pathway), such as intestinal epithelial cells, blood cells, hepatocytes and cells of the immune system. They are then used by the salvage pathway, where the body can synthesise

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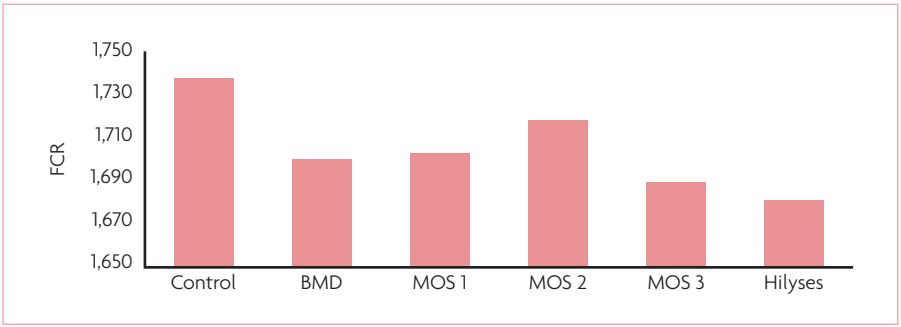
Fig. 2. Performance of broilers fed diets supplemented with yeast mannan oligosaccharide and nucleotides from different treatments: Control (no additives), BMD (Bacitracin Methylene Disalicylate 50g/MT, 1-42 days), MOS 1 (0.5kg/MT, 0 to 42 days), MOS 2 (0.5kg/MT, 0-42 days), MOS 3 (0.5kg/MT, 0-42 days) and Hilyses (1kg/MT, 0-14 days and 0.5kg/MT, 14-42 days) (M. A. Bonato; J. Schliefer; G. D. Santos; B. S. Lumpkins; G. F. Mathis).



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nucleotides with less energy expenditure, as will recycle their bases and nucleotides from metabolic degradation of the nucleic acid of dead cells or the diet.

However, when endogenous delivery is insufficient, nucleotides from exogenous sources become semi-essential or 'conditionally essential' nutrients. This occurs especially in animals during rapid growth stages (early stages), reproduction, stress, and challenges.

Pelícia et al. (2011) showed that nucleotide supplementation in broiler diets (1-21 days) accelerated the turnover rate of intestinal mucosa cells, but for birds from 22-42 days, this effect was not observed. However, when birds were challenged with Eimeria acervulina, in the same period of 22-42 days, there was an increase in cellular turnover rate and a decrease in lesions, accelerating the process of intestinal mucosa regeneration. Supplementation of nucleotides and free nucleosides through diet is important for young animals under challenge. An economically viable option as an exogenous source of nucleotides is Hilyses. Hilyses comes from Saccharomyces cerevisiae yeast that is used in the fermentation of sugar cane to obtain ethanol, where it undergoes cell autolysis and intracellular content hydrolysis. This final product is highly digestible because it contains nucleotides and free nucleosides, amino acids, peptides and polypeptides of short-chain and glutamine, and is highly recommended for animal nutrition (Fig. 1).

There is also the presence of mannan oligosaccharides (MOS, which is an effective tool in the prevention of diarrhoea caused by salmonella and E. coli) and high levels of β-glucans (immunostimulants that are recognised by phagocytic cells present in the intestine, triggering the activation of the innate immune system).

Some studies have been conducted seeking to understand the benefits of Hilyses in pre-starter and initial broiler diets. Recently, two experiments were conducted to study the effects of Hilyses low-dosage on the performance of broiler chickens up to 42 days old.

In the first study, conducted at Southern Poultry Research (Athens, USA) using reused litter, the supplementation of Hilyses (1kg/MT up to 14 days and after 0.5kg/MT until 42 days) improved the broilers' feed conversion at 28 and 42 days, when compared to the negative control and was numerically superior to the other treatments (different MOS sources).

In the study published by Rivera et al. (2017) conducted at the University of São Paulo (Campus of Pirassununga, Brazil), using reused litter from commercial farms, the addition of Hilyses (1kg/MT up to seven days and 0.5kg/MT until 42 days) in broiler diets also resulted in improvement in the feed conversion at 42 days when compared to the negative control group.

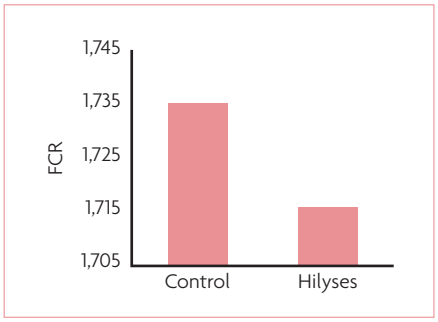

Fig. 3. Effect of hydrolysed yeast and yeast cell wall as alternatives to zinc bacitracin on the performance of broilers from 1-42 days. Treatments: Control (no additives) and Hilyses (1 kg/MT up to 7 days and 0.5kg/MT, 8 -42 days) (Rivera, J.A. 2017.)

These results indicate the benefits of supplementing nucleotides and the yeast cell wall components in pre-starter and initial diets, reinforcing their importance in this period of rapid growth and animal development; carrying these benefits throughout their growth and reflected in better weight gain and feed conversion. ■

References are available from the author on request