# Nutritional management of the pig's immune system

Current intensive animal production systems and a reduction in the use of antimicrobials make it essential to correctly manage the immune system of farm animals to achieve maximum health and productivity.

**by Dr Jose Luis Cano Muñoz, Customer Technical Manager SEMEA, Pancosma. www.pancosma.com**

Great advances in recent years in the knowledge of the immune system have allowed us to better understand the relationship between nutrition and immunity and this can contribute more effectively to improve the health status and productivity of farm animals.

The first factor that determines the relationship between nutrition and immunity is nutritional deficiencies. It is well established that deficiencies in macronutrients or micronutrients can affect the immune system.

## Essential nutrients

Deficiencies in essential nutrients such as amino acids are especially important, so the correct supply and ratio of each of them is critical. For example, piglets fed threonine-deficient diets reduced intestinal mucin production; reduced the number and functionality of intestinal goblet cells; worsened intestinal morphology; and increased diarrhoea, significantly reducing the defence capacity of the intestinal barrier against infections.

In the case of micronutrient deficiencies, their effects on the immune system are well known. It is remarkable that vitamin E as an antioxidant, and microminerals such as selenium, zinc, iron, and copper, etc, play a key role in the development and maintenance of the immune response.

Therefore, in feed it is advisable to use a highly bioavailable source of these micronutrients in an organic form, such as proteinates, glycinates and natural vitamin E, to meet the needs of the immune system as well as for maintenance, growth and production requirements.

Improvements in the nutritional assessment of raw materials, animal needs, the formulation and production technology of feed have allowed us to significantly reduce problems due to nutritional deficiencies and advance to the next step – the nutritional management of the immune system, which is the practical application of functional nutrition.

A practical example is the management of the fatty acid profile in diets to promote immuno-modulation. The amount, ratio and type of Omega-3/Omega-6 polyunsaturated fatty acids in the diet have a great influence on the functionality of the immune system since they determine the synthesis of precursors that intervene in key mechanisms of the immune system, such as inflammation.

Correct nutritional management of Omega-3/Omega-6 in the feed can mitigate the harmful effects of pro-inflammatory states. This is very common in modern production systems due to continuous contact with micro-organisms and stressors that determine a high energy cost and deterioration of the health status of the animals.

From a theoretical point of view, the immune response can be classified into non-specific or innate and specific or acquired immune response. The innate immune response is characterised by non-specific, rapid acting mechanisms aimed at preventing the entry or neutralising of the pathogen.

Phagocytosis, complement, interferon, interleukins, acute phase proteins synthesis and inflammation are part of this response that also have important systemic effects, such as fever, anorexia, changes in metabolism, etc. Natural barriers of the body are part of this system, for example the intestine barrier.

The acquired immune response is triggered by contact with antigens, it is highly specific, it is not immediate because the complex system intervenes, developing cellular and/or humoral protection that is maintained over time depending on the triggering agent. This type of

immunity is enormously effective and efficient from a productive point of view.

## Management is key

The management of immune responses is becoming a key aspect in farms. From a practical point of view we can classify immune responses into productive and unproductive, depending on whether they provide protection against infections and diseases or if, on the contrary, they mainly cause harmful effects, as is the case with inflammatory processes.

It is necessary to promote the first and mitigate the second through sanitary programmes, management and nutritional strategies. Recent research shows that it is possible to modulate these immune responses in a differentiated way by combining biofunctional compounds involved in the systemic regulation of the immune system by stimulating specific cellular receptors present in the intestine.

The use of capsicum and turmeric oleoresins in piglets at weaning increases the expression of genes encoding integral membrane proteins necessary for the formation and maintenance of tight junctions in enterocytes, as well as the MUC2 gene related to mucin secretion by goblet cells in the gut. These results indicate improvements in gut integrity and protection.

On the other hand, these two components administered in piglet feed showed positive effects in acquired immunity in piglets challenged with PRRV virus, producing more CD8+ lymphocyte count at 14 days post infection. CD8+ cells are key cells in the acquired immune response against viruses.

In sows, supplementation with capsicum and turmeric in the feed at the end of gestation caused an increase in the concentration of colostrum protein mainly by immunoglobulins, significantly improving the number of live birth piglets and their survival during the lactation phase in the first and second production cycle. These results are indicative of its beneficial effect on the specific immune system.

Finally, capsicum oleoresin in feed has showed a reduction in biomarkers of inflammation in piglets challenged with E. coli F-18, like counts of neutrophils, macrophages, haptoglobin and C-reactive protein in blood serum, these results are related to immune modulation and anti-inflammatory effects.

The management of the immune system of productive animals is decisive in the current scenario of high productivity and reduced use of antibiotics. It is necessary to enhance the immune capacity of animals to improve their health, but at the same time minimise their potential harmful effects.

This is only possible through coordinated strategies in management, sanitary programmes, nutrition, applying the latest advances in immuno-nutrition and using the best solutions for each situation to achieve maximum health and productivity of farm animals. ■

References are available from the author on request