A new option for health management in pig production: MSPs

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Farmers want to improve zootechnical and economical performance of the herd. In order to do it, health management is essential.

Moreover, the increasing awareness of the threat of antibiotic resistance requires a questioning of traditional therapeutic methods used on farm.

In this context, new molecules are constantly explored. Active molecules extracted from seaweeds count among the most promising ones.

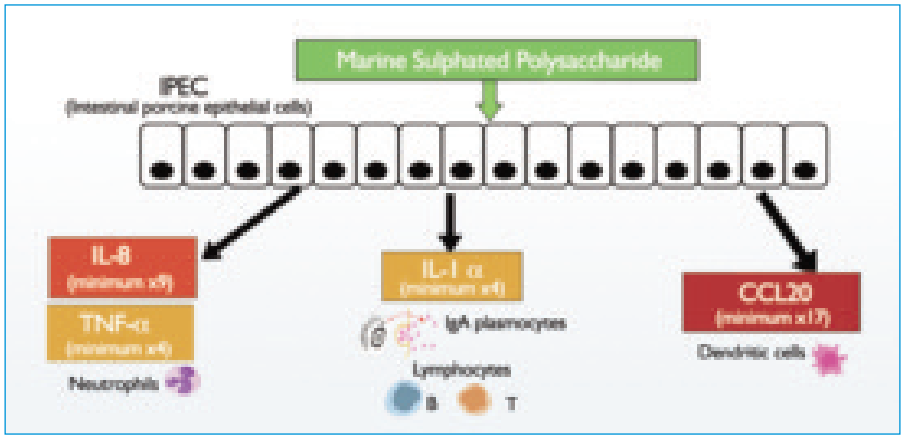

Fig. 1. Expression of cytokines and chemokines mRNA by intestinal porcine epithelial cells (IPEC line) stimulated with Olmix MSP extract.

Seaweeds

In recent years, more and more publications have highlighted the relevance of seaweeds in numerous biological applications.

The regulation of immune mechanisms by the sulphated polysaccharides present in seaweeds is of particular interest. These specific polysaccharides are complex carbohydrates which are not present in terrestrial plants. Unique structural and chemical characteristics give them their numerous biological activities. For instance, Marine Sulphated Polysaccharides (MSPs) have a great structural variability, which offers a high capacity to transport biological information. Indeed their flexibility is favourable to the regulation of different cell-cell interactions in higher organisms.

In addition, one of the particularities, that numerous marine polysaccharides possess, is a polyanionic and sulphated character, which confers them a high chemical reactivity. Some examples of such polysaccharides include agar, ulvans, carrageenan and fucans.

Role and effect on immunity

Marine Sulphated Polysaccharides, which are widespread in seaweeds, have been shown to possess varied biological properties as anti-infectious (anti-viral, anti-bacterial, anti-tumoral), antioxidant, anti-thrombotic and immunomodulatory activities. Therefore, they could be used in farm animals to stimulate immune responses or to control the activity of immune cells in order to mitigate the negative effects triggered by inflammation.

One of the MSP 'immunomodulatory' action's pathways occurs via the activation of cell-associated pattern recognition receptors such as TLR (Toll-Like Receptor).

TLR are immune and epithelial cells' transmembrane proteins, which detect invading pathogens by binding to ancestral molecules of microbial origin called Pathogen-Associated Molecular Patterns (PAMPs).

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Fig. 2. Modulation of immune activity by microbial LPS recognition.

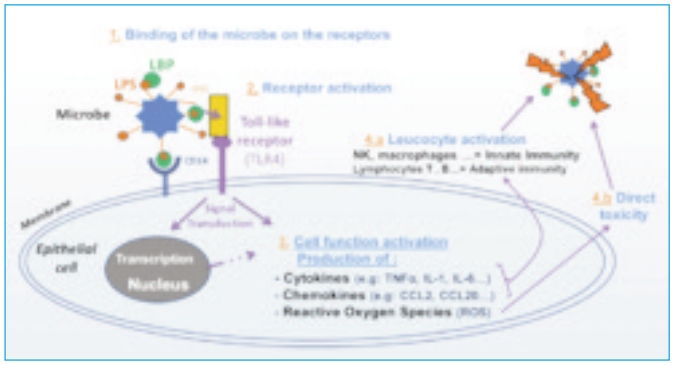
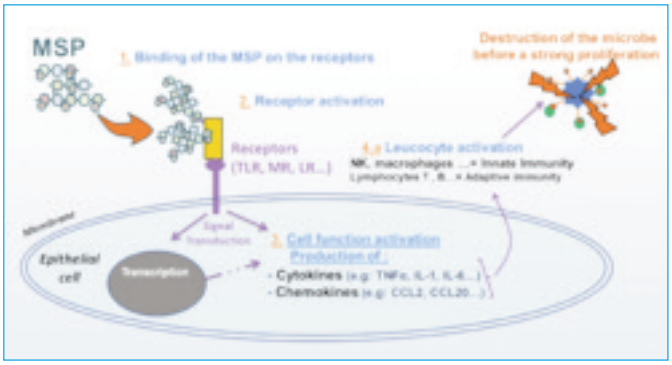


Fig. 3. Modulation of immune activity by Marine Sulphated Polysaccharide recognition.



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It therefore appears that TLR play a key role in the adaptive immune response. Nevertheless, signals produced by their activation lead to the stimulation of numerous other immune cells and functions. In consequence, they are essential elements of both: innate and adaptive immune mechanisms.

In vitro study

A study conducted by the French Institute of Agronomic Research (INRA) showed that this specific MSP extract could stimulate the expression by porcine intestinal epithelial cells of a broad range of immunological factors involved in the recruitment of lymphocytes, dendritic cells and neutrophils (Fig. 1). The mode of action is a recognition of the MSP extract by the TLR4 receptor, which initiates signal transduction pathways leading to the expression of genes that control innate immune responses and further instruct the development of antigen-specific acquired immunity.

The activity of this MSP as TLR activating agents might be the result of a certain structural similarity between these marine polysaccharides and molecular structures that are characteristic of microbial pathogens such as bacterial lipopolysaccharides (LPSs).

Bacterial LPSs are a type of structure present on the bacterial external membrane and recognised as bacteria-specific recognition elements (Figs. 2 and 3).

Microbes have a high multiplication capacity. In consequence, the immune system is often surpassed due to the time required for its activation. In that case, the infection leads to the disease. The interest of this MSP would be to stimulate the innate immune system, to increase its reaction capacity in maintaining the pathogen population at a non-invasive level and/or to contribute to the destruction of the microbes before multiplication.

Applications for pig health

In conclusion, seaweeds appear to contain sugars in the form of polysaccharides. Some of them – the sulphated polysaccharides – are polyanionic complexes which possess various biological properties.

A vast number of studies have already shown the effects of some of these sulphated polysaccharides, particularly the fucoidans, the carrageenans and the ulvans, on certain mechanisms of inflammatory response and on immunity.

The identification and selection of these polysaccharides extracted from suitable seaweed make possible the use of these molecules as agents for the stimulation of various mechanisms associated with the body defence and, in particular, of the innate immunity mechanisms.

In this context, Olmix has developed Searup in order to stimulate the immune system and to restore possible imbalance. It contains the MSP 'immunomodulatory', a MSP 'anti-stress', vitamins (E, A, D3, B complex) and fatty acids.

Two non-exclusive Searup administrations are proposed to improve pig health performance on farms:

- Around stress periods like weaning, Searup allows the pig's defences to be reinforced via the stimulation of innate immunity which is the first line of defence against pathogens.

For piglets, it is recommended to administer Searup at weaning and the two following days, and then, once a week for maintenance of the immunity level.

Marine Sulphated Polysaccharide.

- As part of a vaccination program, Searup enhances the vaccine protection. It improves the immunological impact and the persistence of a high protective level of the vaccine and thereby improves the technical and economic performance of vaccination programs.

In pig production it is recommended to administer Searup one day before vaccination and the two days after.

Results from farm trials

Different trials carried out on piglets around the world – using Searup at weaning and around vaccination – show an improvement of the zootechnical performance (compared to a control group which did not receive Searup).

The results showed:

- An increase in viability rate (97.48% against 98.89% in the Searup group).
- An increase in daily weight gain (523g/day against 542g/day).
- A decrease in feed consumption ratio (1.46 against 1.34). ■