

From the sow to the post-weaning piglet: gut microbiota management

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Over the past decade or so, pig production has evolved tremendously and the industry has had to adapt to face issues linked to sow hyperprolificacy and management practices. At the same time, antimicrobial usage reduction has become a worldwide concern within the 'one health' context.

Some 15 years ago, the use of Levucell SB (*Saccharomyces cerevisiae* boulardii CNCM I-1079) was in its early days in swine, and the research and development journey was just starting. Today, from sow to piglets and now on to fattening pigs, the live yeast concept and applications of *S. cerevisiae* boulardii CNCM I-1079 benefit from sound science, with documented benefits along the whole production cycle.

It all starts with the sow

Modern sow management and genetics, while optimising production performance through hyperprolificacy, have generated new issues such as lower piglet vitality, increased incidence of piglet neonatal diarrhoeas etc, all detrimental to piglet health and future growth performance.

Claudio Oliviero, an expert in sow health and particularly the whole farrowing phase, from the University of Helsinki in Finland showed the link between large litter size and reduced piglets vitality, birth weight, as well as immunity. In their first days of life, while their own immune response is settling in, piglet defences rely on passive immunity from the mother, through colostrum intake. As early as six hours post-farrowing, the level of Immunoglobulins G (IgG) in sow colostrum is halved.

Longer farrowing time delays the intake of the precious colostrum, hence its quality, while large litters impact the quantity received per piglet. A recent survey indicates that around one third of piglets receive insufficient colostrum (less than 250g/piglet). A reduced colostrum intake in the first 24 hours of life has negative effects on piglet survival and growth. Oliviero recommends evaluating colostrum IgG level on

farm using a refractometer: there is a documented correlation between colostrum IgG level and the Brix value. It is actually this method that was used in Colombia by Eduardo Bernal, from SpinVet in order to assess in farm settings the effects of *S. cerevisiae* boulardii CNCM I-1079 on sows' colostrum immune quality.

Sows (123 in total) from four different farms received either a control diet or Levucell SB supplementation for 30 days prior to farrowing. The Brix index showed an increase of the number of sows with adequate IgG level in the colostrum. Bernal concluded from this field trial that the live yeast could potentially improve the transfer of passive immunity from the sow to the neonatal piglet and that this improvement is especially interesting in young sows.

Such farm results corroborate previous research that was presented by David Saornil, Product Manager - Swine applications, at Lallemand Animal Nutrition. This study showed, using lab IgG analysis methods (ELISA), a 21% improvement in the colostrum IgG level with Levucell SB.

Oliviero reviewed some additional nutritional and management strategies that can help preserve piglet immunity in large litter. He stressed, in particular, the importance of feeding high fibre diet in lactation. The abrupt transition between high fibre maternity diet and high energy/low fibre lactation diet is detrimental to the sow's digestive function, transit (adding to the constipation trend around farrowing), as well as microbiota according to more recent data.

Yannig Le Treut, General Manager for Lallemand Animal Nutrition, came back on the management of hyperprolific sow digestive balance. He reminded the audience that *S. cerevisiae* boulardii CNCM I-1079 can be an effective tool to help improve sow's transit and reduce constipation around farrowing. This was one of the very first benefits of the live yeast observed in swine, 13 years ago.

Other benefits of the live yeast that were documented along the years include improved piglet vitality at birth and higher sow feed intake in lactation. Today, thanks to new



metagenomics techniques, such observations and our hypothesis about shaping the sow's intestinal microbiota with *S. cerevisiae* boulardii CNCM I-1079 have been confirmed. Such recent studies indicate that the farrowing process strongly affects the sow microbiota.

S. cerevisiae boulardii CNCM I-1079 supplementation, on the other hand, lead to a much more stable faecal microbiota around farrowing. How is this effect translated into performance of hyperprolific sows?

Le Treut presented new results from a recent trial carried out with Danbred genetics in Spain, indicating that the live yeast improved performance parameters (sow body fat thickness gain in gestation and piglet growth) and that the best outcome is obtained by applying the yeast during both gestation and lactation, as compared to a double dose only in lactation.

Preserving piglet gut health to manage neonatal diarrhoeas

Neonatal diarrhoea in piglets is also an issue linked to large litter size. Francesc Illas, from Grup Batallé, in Spain, estimates that, in a 1,000 sow level farm, neonatal diarrhoeas could cost producers at least €30,000 in production losses (mortality and reduced growth).

It is mainly a question of balance and various elements should be taken into consideration to aim for an equilibrium between infection pressure, immunity and management of the facilities (for example hygiene, ensuring comfort, especially in terms of temperature). The Batallé Group oversees 1,000 farrows every week.

Today the group has in place some specific protocols for the prevention and treatment of neonatal diarrhoea, while they aim for zero losses, to maintain weight at weaning and to send healthy piglets to nurseries in order to maximise the potential of their genetic.

David Saornil further discussed the issue and causes of neonatal diarrhoeas, stressing the importance of maternal transfer in terms of immunity and microbiota in piglet's early life, two crucial elements of the balance. If we are able to modify the sow microbiota profile we can act on the piglet. Exploring the science behind *S. cerevisiae* boulardii CNCM I-1079 mode of action he showed the various lever of action of the probiotic yeast on piglet, through the sow:

- Stabilisation of the piglet intestinal microbiota, through potential microbial maternal imprinting.
- Maintenance of the gut integrity.
- Control of the inflammatory reactions.
- Improved colostrum immune quality.

These were confirmed via several trials showing that, under various conditions, Levucell SB has a positive impact on newborn piglets, reducing either diarrhoea incidence or its duration.

Microbiota management: what about the brain-gut axis?

Vassilia Théodorou, Director of the Neurogastroenterology & Nutrition Group and Head of INRA Toxalim in France, and an expert in human

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nutrition, drew the link between the gut, the brain and the microbiota in an enlightening presentation.

There is now clear evidence that the brain-gut axis is a two-way communication route that also involves a third player: the microbiota. This has been demonstrated in both human and animals. Stress, for example, illustrates perfectly the bidirectional microbiota-brain-gut interplay. Stress can impair intestinal barrier function (leaky gut), visceral pain, and lead to gut microbiota dysbiosis. Conversely, prevention of gut leakiness can attenuate the hypothalamic pituitary axis response to stress.

According to Theodorou, this suggests that modulation of the gut microbiota by probiotics may contribute to improve stress-related gut “leakiness”, source of dysbiosis, visceral pain, or gut discomfort, through restoration of the microbiota-brain-gut axis. This could easily apply to pigs.

Strengthening piglet immunity post-weaning

Jeff Carroll, research leader, USDA-Agricultural Research Service, in the USA, focused on the piglets after weaning. He aims at searching for

alternatives to medicated diets which could provide the immunological protection necessary to maintain a high level of productivity in pigs.

His team conducted two studies to further elucidate a possible immunological priming effect of *S. cerevisiae* boulardii CNCM I-1079 in weanling piglets subject to an inflammatory challenge (lipopolysaccharide – LPS- and LPS + salmonella challenges). Various inflammation biomarkers were analysed around the challenge.

Both studies combined indicated a real ‘immunological priming’ effect of Levucell SB, with positive consequences on feed conversion. Carroll concluded that: “*S. cerevisiae* boulardii I-1079 could offer immunological protection to the young pig, thus allowing more nutrients to be diverted towards growth during this critical period of development.”

This direct immune priming effect is combined to the live yeast documented ability to bind undesirable bacteria in the gut and help prevent their accumulation in the gut, as seen in the salmonella challenge model (reduced pathogen load). Piglet immunity and reaction to an inflammatory challenge was further investigated by Imourana Alassane-Kpembi, from INRA Toxalim

in France, a specialist of mycotoxins in swine. He demonstrated that pigs are particularly sensitive to mycotoxins present on cereals. The digestive tract, in particular the intestinal barrier function, and immune system are two of the most sensitive targets of mycotoxin contamination in swine, with consequences on pig health.

Both innate and acquired immune response are affected by mycotoxins, meaning an increased susceptibility to infectious diseases, but also a decreased vaccinal efficacy.

Using transcriptomic techniques (analysis of the expression level of immune related genes within the piglet gut wall), Alassane showed that *S. cerevisiae* boulardii CNCM I-1079 supplementation to piglets can mitigate the detrimental effects induced by deoxynivalenol (DON) at gene expression level in gut tissue by an attenuation of the pro-inflammatory effects of DON.

He also showed that the live yeast is able to restore DON-induced alteration of lipid metabolism signalling.

The weaning piglet session was concluded by a commercial testimonial by Dr. Fu Shuangxi, from Guangxi Yangxiang Agriculture and Animal Husbandry in China.

The Yangxiang group sold two million pigs in 2018 and produces 1.2

million tons of feed.

In 2020, China is ruling out antibiotic growth promoters in feed. To prepare for the ban, Yangxiang has carried out numerous trials, including four with Levucell SB.

These Chinese trials confirmed in commercial farms and research stations settings that *S. cerevisiae* boulardii CNCM I-1079 could effectively improve the feed conversion of post-weaning piglets.

Trials in sows show shorter farrowing duration, with positive consequences on piglet survival in lactation and health post-weaning.

Conclusion

The meeting ended with a forward-looking presentation of swine research and development within Lallemand Animal Nutrition, research which is conducted in partnership with various experts in the field, by R&D Director Mathieu Castex.

He showed that our knowledge of the roles of the intestinal microbiota is building up and our understanding of the interplay with the host physiology is also growing.

Castex concluded that the outlook for future research is bright, thanks to access to new techniques, such as OMICS or the development of in vivo and in vitro models. ■