Helping pigs cope with heat stress through gut microbiota modulation

Heat stress is becoming a major concern for high producing animals in all areas of the globe. Heat stress can have negative consequences on feeding behaviour, growth performance and animal welfare.

by Dr Caroline Achard,
Research Scientist,
Monogastric Center of Excellence,
Lallemand Animal Nutrition.
www.lallemandanimalnutrition.com

Recent microbiota studies help producers to understand how feeding the live yeast Saccharomyces cerevisiae boulardii CNCM I-1079 can help alleviate the effects of heat stress through positive microbiota modulation.

Scientists have shown a relationship between the gut microbial composition and the pig's metabolic adaptation to heat stress. In turn, feeding behaviour, energy utilisation, and, thus, growth performance are preserved.

Microbiota implications in pig adaptation to heat stress

A trial was conducted in partnership with INRAE UMR PEGASE (France) to evaluate heat stress incidence on swine energetic metabolism and feeding behaviour.

Ten finishing boars were housed for 20 days in respiration chambers under thermoneutrality (seven days at 22°C) then under heat stress conditions (seven plus six days at 28°C). They were fed either a diet with or without the live yeast Saccharomyces c. boulardii CNCM I-1079 (Levucell SB).

Thanks to high-throughput sequencing techniques (16S metabarcoding), this study has also provided new insights on the key role of the digestive microbiota under thermal stress conditions.

As confirmed in recent publications, short-term and chronic heat stress challenge has an impact on the microbiota composition.

In this study, heat stressed pigs notably showed increased levels of Clostridium sensu stricto group, Romboutsia and Ruminococcaceae taxa. Levucell SB supplementation attenuated some of these effects while it increased the abundance of the beneficial Lactococcus lactis bacteria and Subdoligranulum genera.

Interestingly, during heat stress, higher levels of beneficial species such as Ruminococcus Bromii and Lactococcus lactis, were positively correlated with better dry matter intake and energy retention.

R. bromii has been described as a keystone species promoting the growth of other micro-organisms able to degrade resistant starch, while L. lactis may beneficially interact with the host immune system. Altogether, this may explain the higher energy retention observed under heat stress.

Preserved performance and metabolism

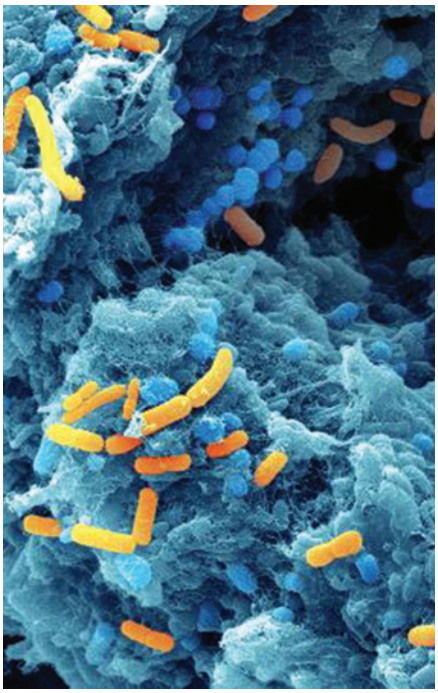
In addition, thanks to the use of respiratory chambers, this trial evaluated the benefit of Saccharomyces c. boulardii CNCM I-1079 on pig metabolism. Indeed, under heat stress, pigs tended to eat less and divert their energy metabolism from growth to ensuring thermoneutrality. The trial indicates positive outcomes in the areas of animal welfare, metabolism and performance:

- While heat stress decreased feed intake in all animals, the pigs fed Levucell SB showed higher feed intake due to larger numbers of meals per day and longer meal duration compared to the control group. At the end of the trial, feed intake was more stable in the Levucell SB-fed pigs than in controls when the heat stress periods were compared with the thermoneutral periods.

- During heat stress, Levucell SB-fed pigs had lower skin temperatures compared to control pigs.

- Feeding Levucell SB helped increase energy retention under heat stress vs. the control. It could be explained in part by the improved gut microbiota balance.

As a result, growth performance was better preserved when feeding the live yeast under heat stress: average daily gain was increased from 1.14 to 1.28kg/d (P=0.03).



Conclusions and extension to sows

The beneficial effects of the live yeast Saccharomyces c. boulardii CNCM I-1079 on feed utilisation and swine performance have been largely documented in research and farm trials.

The present study conducted in respiratory chambers and using high-throughput sequencing techniques provided new information on the benefits of the probiotic yeast in preparing the animals to face challenging conditions such as heat stress.

This study also strengthens the growing body of work documenting the physiological benefits of the live yeast, not only for fattening pigs, but also for gestating and lactating sows, for which the financial impact of heat stress is even stronger.

Other research by Domingos et al. (2021) has already demonstrated positive effects on feeding behaviour and litter performance when the live yeast was fed to late gestating sows under tropical climates. ■

References are available from the author on request