

A better understanding of piglet immune response to intestinal parasites

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Piglets. Credit: citronenrot/Vetmeduni Vienna

Parasitologists from the University of Veterinary Medicine of Vienna are closer to understanding the disease process behind porcine neonatal coccidiosis. The disease affects piglets during the first days of their life and can cause heavy diarrhoea in the animals. The parasite *Cystoisospora suis* damages the intestinal mucosa to such a degree that it threatens the

growth and survival of the pigs. The researchers have now analysed the immune response to the infection. The results were published in the journal *Parasite Immunology*.

Porcine neonatal coccidiosis is a serious parasitic [infection](#) of young piglets that severely damages the [intestinal mucosa](#), leading to diarrhoea and reduced nutritional intake. As the infection reduces animal growth, and because secondary infections can result in increased mortality, the disease is responsible for substantial economic losses at affected pig farms.

"The developing [immune system](#) of neonatal piglets is not yet mature enough to deal with the parasites. For this reason, an infection shortly after birth results in weakened intestinal tissue with appropriate consequences. By comparison, *Cystoisospora suis* is absolutely harmless for adult pigs and their mature immune systems," explains first author Simone Gabner.

Immune cells grow more quickly in the intestines of infected piglets than in healthy ones

Scientists from the Institute of Parasitology at the Vetmeduni Vienna investigated how the developing immune system of piglets responds to an infection with *Cystoisospora suis*. For the purpose of the study, 25 animals aged three days were infected and observed in comparison with another 26 healthy, non-infected animals. The researchers analysed various different immune cells in the intestines of both groups over the course of the first days of life. High levels of so-called gamma delta T cells, a type of cell that recognizes tissue damage and activates the immune system, were found in infected piglets as early as four days after infection. Cytotoxic T-cells were detected eleven days after an infection. These are responsible for the cell death of infected cells and appear to

have an immunologic memory function with regard to porcine neonatal coccidiosis.

Both types of T cells were detected significantly earlier in infected piglets than in non-infected animals. In healthy piglets, the T cells begin to settle in the intestine from about the third week of life.

"Before this, we didn't know which T cells played a part in porcine neonatal coccidiosis. Now we also know at which point they appear in the course and development of the disease. Their exact role in the intestines of the animals, however, remains unclear," Gabner says.

"*Cystoisospora suis* affects epithelial cells in the intestine and destroys the natural barrier against pathogens. This makes secondary infections likely. We still don't know whether the T cells reduce the overall damage to the intestinal mucosa or if they perhaps cause the damage to the intestinal cells."

Innate immune system activated

Gabner and her colleagues also researched various receptors of the innate immune system in the piglets as well as signalling substances which play a part in the inflammatory response. Just four days after infection, the researchers found increased expression of certain pathogen receptors (TLR-2 and NOD2) and signalling molecules involved in inflammatory reactions (TNF- α) in the intestine of the infected animals. The parasite thus triggers the activation of the immune system. "Our research shows which signalling pathways could be involved. The [immune response](#) possibly begins even earlier. This is something to be investigated in future studies. We are one step closer to better understanding the disease," says Gabner.

Mother's milk a source of protection

Previous studies by the research group showed that protective antibodies against porcine neonatal coccidiosis are transferred to the piglets through the sow's milk directly after birth. Sows that had been exposed to the pathogen produced the respective antibodies from which the piglets could then benefit. In a follow-up study, the researchers went one step further. They deliberately infected sows with the parasites during gestation in order to increase the antibody levels in the maternal animals. The aim was to supply the piglets with as many antibodies from the mother's milk during their first days of life as possible. This "milk vaccination" was a success. The piglets of infected sows exhibited a less severe development of the disease than piglets of non-infected sows. The more antibodies a sow transferred to its piglets, the weaker the symptoms exhibited by the [piglets](#).

More information: The article "Immune response to *Cystoisospora suis* in piglets: local and systemic changes in T-cell subsets and selected mRNA transcripts in the small intestine," by Simone Gabner, H. L. Workiczek, K. Witter, F.R.L. Meyer, W. Gerner and A. Joachim was published in the *Journal Parasite Immunology*. [DOI: 10.1111/pim.12116](https://doi.org/10.1111/pim.12116)
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