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Swine Newsletter

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1. Study on the impact of nonsuckled teats in gilts

Non-suckling of a teat straight after farrowing induces a regression of the development of the mammary gland concerned within 7 to 10 days post-partum. This regression becomes irreversible after 3 days. If the teat is suckled, regression takes place during the week after weaning. However, studies have already shown that at the end of regression, suckled teats are larger than nonsuckled teats.
A team of animal scientists and veterinarians from Canada and Denmark tried to establish the impact of teat suckling on the productivity of the mammary gland during the subsequent lactation.

Two groups of 22 first-parity sows of the same genetic origin were formed. In the first group (control), the same six teats were left available for suckling for two subsequent lactations. In the other group, different teats were suckled during each of the two lactations (during the first lactation, the same 6 teats were available as in the control group). The other teats were sealed off with tape and tapes were checked twice daily. After farrowing, the litters were standardised to 7 piglets and at 48h post-partum, the number of piglets was reduced to 6 (one piglet per available teat). During the second lactation, piglets were weighed individually within 12 h of birth, and on days 2, 4, 7, 21, 35 and 56. Piglets were weaned on day 17-18. On the day of weaning of the second lactation, 16 sows of each treatment group were slaughtered and 4 functional mammary glands were collected from each sow.

Even though they received the same diet, control sows consumed significantly more feed during lactation than “treated” sows, which tallies with the difference in milk production observed in the second part of the study. There was no difference in serum prolactin levels or in the changes of these levels between the two groups during the second lactation.
Weight gain was significantly higher in control piglets compared to “treated” piglets, between days 2 and 14 ($p<0.05$); they weighed an average of 1.12 kg more on day 56 ($p>0.05$). There was a trend to more fights at the udder among “treated” piglets ($p<0.10$).
The quantity of mammary tissue per accessible teat was significantly higher in control sows compared to “treated” sows ($p<0.01$). There was also more DNA (hyperplasia) and RNA (metabolism) per mammary gland in control sows ($p<0.01$).

The authors estimate that their findings “clearly show that teats that were suckled in first lactation produce more milk and have a greater development in the second lactation than nonsuckled teats”, regardless of the location of the teats concerned.
They note it would be interesting to determine, under similar experimental conditions, if colostrum production is also affected by previous suckling. They suggest this might be the case as the differences between groups are more marked during the first week of lactation than during the second. These observations are of practical interest as they impact on the hunger and weight gain of piglets.

Farmer C. et al., Milk production in sows from a teat in second parity is influenced by whether it was suckled in first parity. Journal of Animal Science, 2012, 90, 11, 3743-3751

ISPAIA comments: For hyperprolyfic litters, lactation and feeding should be well managed to avoid wearing out first-parity sows and be faced with a severe second-parity syndrome.

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2. Impact of the photoperiod on the development of the immune system

The relation between photoperiod and immunity is controversial. Studies in pigs found that 16 hours of light per day during gestation and lactation periods stimulate the development of immune cells in piglets, while studies in other species associate this effect with a short photoperiod (8 h/d). A team of animal scientists and agronomists from Quebec decided to try and get to the heart of the matter.

Gilts were subjected to 12 h of light daily during gestation. On day 111, they were randomly assigned to one of two groups:

- Short photoperiod (SP), consisting of 8 h of light daily from d 112 of gestation to d 23 of lactation (weaning);
- Long photoperiod (LP), consisting of 23 h of light daily from d 112 of gestation to d 4 of lactation, followed by 16 h daily until d 23 of lactation.

On d 2, litter size was standardised to 10 piglets. On day 4 of lactation, all sows were transferred to a new housing to ensure that all animals were subjected to the same stress, while the photoperiod change coincided with the change of housing for the LP group alone.
On d 15, a female and a male piglet of each litter were selected and immunised with 1 ml of vaccine containing 2 mg of ovalbumin (0.5 ml injections on both sides of the neck). At weaning (d 23), the same piglets received a second immunisation with the same vaccine which now also contained a lysozyme. From this day, piglets were exposed to light 12 h per day. Blood samples were taken from each piglet between 9 and 10 am, on d 15, 23, 30, 37 and 44 to assess the neutrophil and lymphocyte population and the antibody response.

The percentage of neutrophils that phagocytized *E. coli* particles *in vitro*, as measured on d 15, was significantly less in SP piglets than in piglets maintained on LP ($p=0.001$). By d 23, this difference had disappeared, although the phagocytosis capacity remained greater in piglets exposed to LP on d 23. However, the SP piglets developed a stronger primary and secondary IgG response to the two vaccinal antigens ($p=0.003$ and $p=0.0001$). Not surprisingly, the lymphocyte response to an *in vitro* activation by one of the vaccinal antigens had also increased in SP piglets ($p=0.02$ on d37). Similarly, in SP piglets, cell populations of memory (CD4+/CD8+) and cytotoxic (CD8+) lymphocytes as well as NK cells were significantly larger than in LP piglets until d 30 (one week after return to a photoperiod of 12 h daily). The percentage of B cells among lymphocytes was also greater in SP piglets.

This is the first experimental evidence of the impact of the photoperiod on humoral immunity. The duration of the photoperiod to which piglets are exposed during lactation has an impact on the cell production and function of both innate and adaptive immunity. A short photoperiod reduces the activity (but not the population) of phagocytic cells, but is favourable for the development of specific immunity. According to the authors, the increase in melatonin secretion might explain these observations. However, a long photoperiod during lactation should be considered having a negative impact on piglets.

Lessard M. et al., Impact of a long photoperiod during lactation on immune status of piglets. Journal of Animal Science, 2012, 90,.10: 3468-3476

ISPAIA comments: These different elements should be taken into account when discussing the optimal photoperiod. Its impact on reproduction is controversial. For example, work by Prunier et al. (1993) also showed a benefit of a short photoperiod. However, this is not without consequences on the bodyweight at weaning. The number of suckling sessions per day is reduced with a shorter photoperiod. This is why a compromise of 12 h of light per day is most often put forward.

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3. Selection for resistance to enzootic pneumonia

A group of Japanese geneticists aimed to select a Landrace pig line with improved resistance to enzootic pneumonia, leading to reduced need for antibiotic use and increased productivity. The selection took place over five generations between 2003 and 2008, but without a control population.

The selection traits were daily gain (ADG), backfat thickness (BF), mycoplasmal pneumonia pulmonary lesion score and a range of parameters linked to both innate immunity (white blood cell count, phagocyte activity, complement pathway activity) and acquired immunity (antibody response to sheep red blood cells). Plasma cortisol concentrations were also measured. In each generation, one to two male piglets and two to three female piglets were selected from each litter to constitute the next generation (1564 animals in total). Boars were raised individually in performance testing crates, while gilts were raised in groups of ten in feeding pens. In parallel, their litter siblings were subjected to natural infection by *M. hypopneumoniae*. Part of these piglets was raised in a clean environment, the other part in a dirty environment (no changing or cleaning of bedding). Piglets were weaned at four weeks of age and selected at seven weeks of age.
In five generations, the estimated heritability was 0.60 for ADG, but 0.07 for the lung lesion score (which was correlated to the heritability of the cortisol level, estimated at 0.20). In the “clean” group of animals, the lung lesion score reduced greatly until the third generation after which it was virtually nil. For the “dirty” group, it decreased until the third generation, then increased in the fourth generation and decreased again in the fifth generation. However, the percentage of animals with a high lesion score reduced with each generation. Is the genetic resistance to enzootic pneumonia only hereditary if the pigs are hardly exposed to risk factors? The authors do not provide a clear answer; they underline that the comparison between “clean” and “dirty” groups allowed a better understanding of the reproductive value of the “lung lesion score” parameter.
According to the authors, they “successfully improved resistance to swine mycoplasmal pneumonia and meat production traits in Landrace pigs by direct selection in five generations.”

Kadowaki H. et al., Selection for resistance to swine mycoplasmal pneumonia over 5 generations in Landrace pigs. Livestock Science 2012, 147, 20–26

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4. *In vitro* study of the activity of zinc oxide on the intestinal flora

A German study aimed to determine the MIC of zinc oxide (ZnO) against 75 reference strains of enterobacteria of porcine origin. Depending on the culture media (adapted to the bacterial species), total zinc concentrations in the ZnO saturated media were 520 µg/ml to 580 µg/ml (ppm), similar to zinc concentrations in the small intestinal chyme of pigs provided with 3000 ppm ZnO feed. The 75 strains were selected from bacteriological collections to cover the commensal intestinal flora of pigs.

Strains proved to be sensitive, intermediary or resistant to zinc oxide, although species of the same family did not necessarily have the same sensitivity, even if 70% of *Lactobacilla* strains were resistant to ZnO. The majority of *Bacillus* spp and *Streptococcaceae* were sensitive to zinc, the *Leuconostoc* spp showed intermediary and *Clostridium perfringens* showed high zinc resistance. Commensal strains of *E. coli* were found to be more resistant than the pathogenic strains, which is coherent with the use of ZnO in the field.

However, none of the enterobacteria was found to be very sensitive to ZnO and the authors conclude that the efficacy of ZnO on post-weaning diarrhoea remains to be explained. They suggest that modifications of enterobacterial diversity may be more relevant than a direct inhibition of *E. coli*. The authors conclude that this *in vitro* study suggests that the resistance of intestinal bacteria against ZnO is species specific and that these findings only partially explain its effect *in vivo*.

Liedtke J. et al., In vitro antibacterial activity of zinc oxide on a broad range of reference strains of intestinal origin. Veterinary Microbiology, 160, 1-2: 251–255

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