How farrowing impacts a sow’s digestive transit

The effect of farrowing on the sow’s digestive tract has often been underestimated. Constipation around peripartum does have negative side effects. Optimising diet formulation by taking into account the interactions between yeasts and the diet might help to reduce problems.

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Sow constipation in late gestation is a recurring problem for producers: a study at Cooperative Research Farms (CRF) Sow Nutrition Research Farm in Québec, Canada estimates that the majority of sows in farms experience three to four days of interruption of bowel movement in peripartum (CRF trial, 2006). Hormonal changes, increased volume of the litter in the last days of gestation, lack of activity of the sow, as well as changes in feed formulation are many sources of stress that will be translated into a slow-down of the animal’s digestive transit.

The impact of this phenomenon is often underestimated as the digestive transit plays an important role in both the farrowing process and early lactation. In addition to the related potential health issues – decreased feed intake, increased urinary tract infection risks –, constipation leads to dysfermentations in the gut.

Defined as an uncontrolled growth of bacteria such as coliforms and clostridia, dysfermentation is a source of digestive discomfort for the sow, with the production of gases leading to dilatation and hypersensitivity, increasing the risks of partial organ torsions and hypoxia. It can also cause the production of bacterial toxins (e.g. from Clostridium sp.), with possible transfer to the litter through blood, milk or faecal matters.

Collaborative research programme

However, despite its impact, sow digestive physiology around farrowing has been poorly studied. There is limited literature on the subject, even though nutritionists and veterinarians put a lot of effort in trying to better control the disorders linked to farrowing. Due to this, a collaborative research programme was designed by Lallemand Animal Nutrition and the experienced international organisation, Cooperative Research Farms, headquartered in Richmond, Virginia, USA. The aim was to better characterise the changes in sow’s digestion in peripartum, the impact of the diet components, in particular its fibre content and the addition of probiotic yeast (S. boulardii).

In this programme, a preliminary study was first performed in France to validate the methodological approach designed to characterise sow’s digestive transit. This was then transferred to a larger number of animals at a CRF Sow Research Farm in Québec, where the effects of the diet and probiotic yeast supplementation were also studied. In parallel, molecular biology analysis techniques were applied to profile the sow’s digestive microflora populations and evaluate the impact of farrowing and the diet on these profiles.

Preliminary study

A preliminary study was performed on twenty pigs in Brittany, France (Lallemand, 2006) to validate the approach used to follow digestive transit. The sows were fed diatomaceous earth (see box) mixed with their feed in a single delivery prior to their transfer to the maternity unit. Diatomaceous earth is used as a tracer of the digestive transit: sow faeces were then analysed for total ash content and compared to baseline level.

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Diatomaceous earth

Diatomaceous earth (or diatomite) is a naturally occurring, soft, chalk-like sedimentary rock that consists of fossilised remains of diatoms, a type of hard-shelled algae. It is easily crumbled into a fine talcum-like powder. The typical chemical composition of diatomaceous earth is 86% silica, 5% sodium, 3% magnesium and 2% iron and many other trace minerals such as titanium, boron, manganese, copper and zirconium. It is used as a mineral based pesticide. Since it contains 99.5% (DM) indigestible mineral matter, it was used in this study as a tracer of the sows digestive transit: the sows ingested a fixed amount of diatomaceous earth given a moment and their faeces were analysed for mineral matter content as compared to baseline level (before the diatomaceous earth intake). The variation of faecal mineral contents reflects the secretion of the diatomaceous earth meal. Diatomaceous earth has very limited water retention capacity, which means its effect on gut motility is very limited.

of monogastric specific live yeast S. cerevisiae boulardii L-1079 (Levuccell SB 20, Lallemand). Thirty-six hours prior to their transfer to maternity, all sows received 150 g/sow of diatomaceous earth (Silikil ND). The following day, the treated group received 1 g/sow/day of live yeast. Faeces were collected by direct sampling in the rectum (partial collection), every morning and evening during the five following days. Faeces dry matter and ash contents were analysed. (Figure 1).

This study confirmed the negative impact of stresses (transfer, farrowing) on sow’s digestion. The team could observe an increased duration of the digestive transit around farrowing: in the control group, over five days are necessary for the excretion of all the diatomaceous earth (when the ash content is back to baseline level). The literature reports an average transit duration of 2.25 days in sows.

For the control group, it was impossible to collect faecal matter during the first 12 hours following transfer. The rectums were empty and the sows did not defecate during transfer. Later, the average ash content in control sows faeces showed a short peak before decreasing progressively. A second peak appeared at 96 hours. These two peaks were not the fact of sows sub-groups, as the individual values were quite random with high standard deviations.

This first study demonstrated that the stress caused by the transfer of animals from one building to another interrupts the digestive transit. In addition, the digestive transit around farrowing was erratic.

However, when the sows received S. boulardii, the excretion of faeces did not show any interruption. There was an early peak of excretion, higher than for the control group, followed by a regular and steady decrease of the ash content up to day 5. In the treated group, the ash content standard deviations were low, reflecting an increased homogeneity amongst sows regarding excretion pattern. The live yeast appears to reduce the effect of stress on sow’s digestion. While this was not investigated in this study, it is possible to link this to a reduction of dysfermentations and increased stability of the sows digestive flora with the probiotic yeast.

The fibre effect

When comparing the high fibre diet (C) to the low fibre diet (A), the team observed:

- Improved faecal consistency, the faeces are less hard when compared to low fibre diet
- No sign of constipation: early excretion peak as compared to low fibre diet
- Improved excretion quantity
- Improved transit speed

The yeast effect

The live yeast exerts more effects when given together with a low fibre diet:

- Improved faeces consistency: there are fewer black bead type excretions when compared to control diets
- Improved transit with the low fibre diet: transit is more regular, with earlier and higher excretion peak
- Reduced number of sows experiencing interruptions in bowel movements when fed the low fibre diet (13.5 % vs. 17.9%)
- A positive effect on faeces colour
This new study confirms the benefits of probiotic yeast in peripartum, in particular with a low fibre diet, on improving sow’s transit.

**The effect of age**
Interestingly, when pooling the sows according to their parity, the study shows a clear effect of sow’s age on their digestive transit. Transit slows down as sow’s parity increases. This is linked to anatomical and physiological changes in sows. In particular, a longer hindgut in older animals accounts for an increased transit duration. Moreover, older sows are more sensitive to constipation.

**Effects on the gut ecosystems**
Using cutting-edge molecular biology analysis tools, such as DNA fingerprinting, but also in-house developed DNA microarray chips, used here for the first time to analyse a gut system, the team looked at the evolution of the gut microflora populations to see how the farrowing event, the diet fibre content and *S. boulardii* supplementation impact the microflora populations.

Dendrogram analysis (Figure 3) of the DNA fingerprint banding profiles formed two distinct clusters based on diet (similar microflora profile). Within each dietary cluster, yeast treated animals also tended to cluster together. When fed the high fibre diet with the yeast, the faecal microflora was more stable and more closely related to the days prior to farrowing.

Microarray DNA chip analysis also confirm that a difference of diet leads to differences in the gut microbial composition. Fibrolytic-type microfloras, comprised predominantly of ruminococci, were more abundant on the high fibre diet. Whereas, on the corn soy diet, amylolytic lactic acid bacteria and lactate utilising bacteria like *Megasphaera elsdenii* were more abundant in the faeces. The low fibre diet also showed a greater degree of diversity. These results indicate that dietary changes or a stress such as farrowing induce significant changes in the sow’s faecal flora, as demonstrated by changes in the banding pattern.

However, the addition of *S. boulardii* allows producers to control the impact of stress upon the faecal microflora, as well as the number of pathogens in the gut. This is due to the live yeast properties and its stabilising and protective effect upon the sow’s endogenous microflora and faecal flora. PP

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