

Le Corps professoral de  
Gembloux Agro-Bio Tech - Université de Liège vous prie  
de lui faire l'honneur d'assister à la défense publique de la dissertation originale que

**Madame ZHAO Xuemei,**

**Titulaire d'un *master's degree of agriculture (Animal Nutrition and Feed Science)*,**

présentera en vue de l'obtention du grade et du diplôme de

**DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,**

le 24 mai 2022, à 13h,

[en visioconférence.](#)

Cette dissertation originale a pour titre :

« The influence of different feeding strategies during critical time points at gestation, lactation or weaning on the performance of sows and piglets ».

**Le jury est composé comme suit :**

Président : Prof. J. BINDELLE, Professeur ordinaire,

Membres : Prof. M. SCHROYEN (Promotrice), Prof. X. LI (Copromoteur – CAAS, Chine), Prof. M. LAITAT, Prof. J.-L. HORNICK, Prof. N. EVERAERT (KU Leuven).

## Summary

Feeding strategies may directly influence the performance of pigs, especially during critical time points during their life. In this PhD, we focus on three different and important stages in pig production: gestation, lactation and the weaning period. We designed three experiments using different feeding strategies to examine the influence of feed on the problems often occurring during these critical times and to investigate if the profitability can be augmented using these feeding strategies.

In a first experiment, we focused on **the early gestation period**. Pregnancy loss during early gestation is a significant problem with a profound impact on pigs. Maternal protein and energy intake play decisive roles in embryonic survival during early pregnancy. In this first experiment, five different **protein and energy diets** were fed to gilts throughout the first month of the pregnancy to study the effect on several parameters: embryonic survival rate, P4 concentration, expression of the progesterone receptor (PGR) and important nutrient transporters in the uterine endometrium. At day 0 of gestation, 40 gilts were randomly allocated to 5 diets with low (L), medium (M) or high (H) levels of crude protein (CP) and metabolizable energy (ME) ( $L_{CP}L_{ME}$ ,  $M_{CP}L_{ME}$ ,  $H_{CP}L_{ME}$ ,  $L_{CP}H_{ME}$  and  $H_{CP}H_{ME}$ ). Gilts were fed two times a day until day 30 of gestation. Results showed that increasing maternal protein or ME intake had a positive effect on embryonic survival. Increased protein intake by 20% or 40% did not elevate plasma P4 levels but increasing ME intake by 40% improved plasma P4 concentration in low protein diets at day 30 of gestation. Increasing maternal protein or ME intake did not induce PGR expression in the endometrium. Maternal protein and energy intake likely mediated the transportation of cationic and neutral amino acids (AA) from mother to fetus to affect embryonic survival and development.

In a second experiment, our focus was on **late gestation and lactation**, two important periods during a sow's pregnancy. Sows undergo high stress levels at farrowing and a lower feed intake often occurs in the perinatal period. Our second experiment investigated the effects of feed containing **isoquinoline alkaloids (IQ)** given to sows during late gestation and lactation on the performance of both sows and piglets. According to literature, plant extracts containing IQ have demonstrated to have anti-inflammatory properties. In pigs, IQ supplementation has shown to downregulate stress response and improve digestibility of nutrients. So, the aim of the second trial was to investigate the effect of diets with IQ during late gestation and lactation on sows farrowing performance, colostrum and milk quality, as well as on gut development of the piglets and their growth performance. Twenty-three sows were allocated in three dietary groups: A basal diet without supplementation throughout gestation and lactation (group 1, NC), 90 ppm IQ in the diet from gestation day (G) 80 to 107 and 150 ppm IQ from G107 (when entering maternity) until weaning (group 2, IQ1), and 150 ppm IQ from G107 until weaning (group 3, IQ2). The IQ-fed sows lost less body weight. Colostrum of the IQ groups was higher in protein content and IgG levels. However, the IQ treatments showed no effects on zootechnical parameters or physiological measurements in the piglets.

In a third experiment, **the weaning period** was examined. Three to four weeks after birth piglets undergo this stressful period of weaning, which results in low growth rate, intestinal disorders, causing diarrhea and oxidative stress, especially to low weaning weight piglets. Our third experiment focused on the effect of **gallic acid (GA)** as a feed additive given to the piglets after weaning. GA is a natural phenolic compound which has been shown to have antioxidant, antimicrobial, anti-inflammatory, and health promoting effects in animal production. GA supplementation has been shown to decrease diarrhea incidence in weaned piglets and improved their intestinal morphology. So, the aim of the third trial was to investigate whether GA supplementation would increase growth and reduce diarrhea after weaning as well as if it would have an impact on the antioxidant status of weaned piglets. A total of 120 weaned piglets were randomly allocated to 4 treatments in a 42-day experiment with a  $2 \times 2$  factorial design comparing different weaning weights (high weight, HW or low weight, LW) and dietary treatment (control without supplementation (group 1, CT) or with supplementation of 400 ppm of GA (group 2, GA)). Dietary GA had positive effects on growth performance and small effects on diarrhea incidence in low weight weaned piglets. Piglets fed GA always had the lowest values of malondialdehyde (MDA) content in plasma, although these differences were not significant.

In summary, certain impacts were observed when applying the different feeding strategies examined in this PhD. At all stages examined in the three experiments improvements were noticed. As such, changing the protein and/or energy levels in maternal diet had a positive effect on embryonic survival and the supplementation of IQ and GA to sows or piglets also positively affected several parameters measured. This shows that feeding strategies can and should be examined, especially at critical time points in the life of pigs, as a solution to improve the survival, health and overall performance of the animals.