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Agro-Bio Tech

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 LEBLOIS Julie,

Titulaire d'un diplôme de master bioingénieur : sciences agrononomiques,
à finalité spécialisée,

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

DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,

le 28 août 2018, à 16h30 heures précises (personne ne sera admis après cette heure),

en l'auditorium ZT1 (Zootechnie, bât. 1),

Passage des Déportés, 2, à 5030 GEMBLOUX.

Cette dissertation originale a pour titre :

« Early life programming of piglets' microbiota and gut health by maternal dietary fibre supplementation ».

Le jury est composé comme suit :

Président : Prof. P. JACQUES, Professeur ordinaire,
Membres : Prof. N. EVERAERT (Promotrice), Prof. J. BINDELLE (Copromoteur), Prof. Y. BECKERS, Prof. S. MASSART, M. J. WAVREILLE (CRA-W), Dr I. LE HUËROU-LURON (INRA Saint-Gilles, France).

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Summary

Post-weaning diarrhoea (PWD) is a widespread disease causing loss of weight and mortality of the piglets. To cure or prevent PWD, the treatment of pigs with antibiotics is frequent. The overuse of these substances led to the appearance of multi-resistant bacteria, raising public health issues. Thus, finding sustainable alternatives to antibiotics for PWD curation is of major importance. Most research focusses on the use of substances like prebiotics able to affect the microbiota of the piglets, as gut microbiota is responsible for the maturation of the intestinal immune system. Promoting a beneficial microbiota as early in life as possible is a good strategy for a better future health and a lower prevalence of PWD. Our hypothesis was that using dietary fibres (wheat bran and resistant starch) in the diet of sows would alter their microbiota and in turn affect their piglets' microbiota and future health. In addition, the ability of the two fibre sources to alter milk composition, also affecting piglets' performances and health, was tested. This hypothesis was challenged with two animal experiments.

Results indicated that wheat bran (WB) and resistant starch (RS) had the ability to alter sows' microbiota during gestation but not anymore during lactation, possibly limiting a differential microbial transfer to their offspring. These two dietary fibre slightly altered milk composition. Maternal wheat bran had the ability to increase the villus height and villus to crypt ratio in the small intestine of the progeny, while resistant starch increased the gene expression of tight junction proteins at weaning. These two fibre sources included in a high level in sows' diets did not affect their performance or their piglets', making their use in animal diets realistic.

A second objective of the thesis was to unravel whether the diet of sows could program the metabolism of piglets for later life, using them as model for human. For this, piglets were challenged with a high fat diet in order to induce low-grade inflammation and/or obesity symptoms. After 7 weeks on a high fat diet, piglets had an increased backfat thickness and higher serum cholesterol levels. The main findings are that feeding sows resistant starch increased the total sum of short-chain fatty acids (SCFA) production in the caecum and colon of their progeny, which is beneficial but did not impact the microbiota of the pigs. Moreover, maternal RS diet seemed to increase the barrier function of the colon due to a higher gene expression of tight junction proteins while the maternal effects on intestinal inflammation were contradictory for TNF-α and IFN-γ. It seems thus that the maternal diet had the ability to decrease gut permeability. However, the high fat diet did not alter the microbiota of the pigs, nor was it affected by the maternal diet.

In conclusion, using dietary fibre in sows' diet had the ability to alter their own microbiota during gestation and milk composition, but the impact on the piglet's microbiota was rather limited. It could be thus interesting to use these diets on piglets' themselves after birth to promote the establishment of beneficial bacteria. Although effects on the microbiota were limited, the maternal diet seemed to affect some aspects of the health of their progeny in later life.