Linoleic acid biohydrogenation and butyrate production upon rolled oats addition to a fed-batch reactor simulating conditions of the colon

Rosemarie De Weirdt[1], Bruno Vlaeminck[2], Veerle Fievez[2], Venessa Eeckhaut[3], Joan Vermeiren[1], Sam Possemiers[1], Willy Verstraete[1], Tom Van de Wiele[1]*

[1] *Laboratory of Microbial Ecology and Technology (LabMET), Ghent University, Coupure Links 653, 9000 Ghent, Belgium*
[2] *Laboratory for Animal Nutrition and Product Quality (LANUPRO), Ghent University, Proefhoevestraat 10, 9090 Melle, Belgium*
[3] *Department of Pathology, Bacteriology and Avian Diseases, Research Group Veterinary Public Health and Zoonoses, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium*

Oats are considered to be healthy cereal grains. Although they have a similar energetic value as other cereal grains, they are nutritionally more interesting because of their high fiber and unsaturated fat content (both approximately 10% w/w). Oat fat consists for 40% out of linoleic acid (LA; c9,c12-18:2), which exerts antimicrobial effects with the butyrate-producing bacteria being most sensitive (Maia *et al.*, 2007; Paillard *et al.*, 2007). Furthermore, among all gut bacteria butyrate-producing *Roseburia* species are most actively biohydrogenating LA to less toxic analogues, such as vaccenic acid (VA; t11-18:1) and hydroxy-18:1 fatty acid (HFA), both precursors of conjugated linoleic acid (CLA) (Devillard *et al.*, 2007). Thus, there seems to be a connection between butyrate production and LA biohydrogenation (Maia *et al.*, 2010). Several reports show that oat fibers have a prebiotic potential, by specifically stimulating the growth of *Bifidobacterium* and *Lactobacillus* species and enhancing butyrate production (Mälkki & Virtanen, 2001; Kedia *et al.*, 2009). In our study, we followed SCFA production and LA biohydrogenation upon addition of rolled oats to 2 fed-batch reactors simulating conditions of the colon. FB1 and FB2, were inoculated with fecal samples obtained from a 25 year old female and 26 year old male, respectively, that received rolled oats on the pair days and predigested SHIME-feed on the odd days. The hydraulic retention time was 10 days and the pH was kept at 6.85-7.00. Daily samples were taken for SCFA and LCFA analysis, and DNA was extracted for quantification of specific bacterial groups.

Both reactors responded quite similar to the rolled oats with a shift from caproate to propionate over time and a growth of the total bacterial community with 1 log unit. However, reactor FB2 was producing more acetate and less butyrate than FB1, demonstrating a disturbed conversion of acetate to butyrate when compared to FB1. Interestingly, FB2 was characterized by a low biohydrogenation activity, while in FB1 LA was efficiently converted to VA. In addition to their different metabolic performance, FB1 displayed higher and more stable qPCR counts of *Bifidobacteria* and *Roseburia* than FB2. Furthermore, FB2 was characterized by a 2 log unit increase of *Lactobacilli*. No differences were found in the *Faecalibacterium prausnitzii* counts. In particular, the presence of *Bifidobacterium longum* in FB1, and not in FB2, is currently being investigated as the possible reason for the differences in butyrate production and LA biohydrogenation efficiency.

Overall, the results from this study support the hypothesis that LA biohydrogenation and butyrate production are connected.