Changing pigs' diets alters the gut microbiota

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Including chicory in cereal-based diets of pigs results in profound changes in gut micro-environment, morphology, and microbial population of pigs, according to a study in the June 2012 *Applied and Environmental Microbiology*. Some of these changes were health-promoting, says principal investigator Jan Erik Lindberg of the Swedish University of Agricultural Sciences, Uppsala.

“Certain types of substrates, such as dietary fiber, escape digestion in the foregut and reach the hindgut of humans and mono-gastric animals, and are becoming important in applied nutrition,” says Lindberg. These substrates, called “prebiotics,” can alter gut bacterial composition, modify intestinal fermentation processes, promote gut development, and possibly improve health.

The changes were similar in the small and large intestines, but they differed for chicory forage and chicory root, says Lindberg. They also differed for both chicory forage and root as compared to the control diet, in potentially important ways, according to the report. For example, a lactic acid bacterium, Lactobacillus johnsonii, is involved in regulating production of the immune compound interleukin-12, while Lactobacillus mucosae is reported to possess probiotic mucus-binding ability. Both lactobacilli were dominant when chicory was included in the diet.

Additionally, the presence of chicory forage in the feed boosted the numbers of bacteria that produce butyrate, a key substrate for the epithelial cells that line the colon, as well as a signaling molecule for the gut immune system, says Lindberg. The major butyrate-producing

bacteria were Faecalibacterium prausnitzii, Eubacterium rectale, and Roseburia sp. As their numbers rose, those of Prevotella spp.declined.

Prevotella are strictly anaerobic bacteria that have been identified as a dominant species in the large intestine of pigs, and are also abundant in the ileum. Additionally, they were found (by other researchers) to be dominant in the gut microbiota of rural African children living largely on millet grain, sorghum, legumes, and vegetables.

Pigs fed chicory roots contained copious Megashaera elsdenii, a bacterium which is abundant in the colon of pigs fed a diet designed to prevent swine dysentery.

The research originated in the search for prebiotic fiber sources, says Lindberg. “In this context, chicory was a good candidate as both the root and the above-ground biomass, the forage, can be eaten by animals and humans. We knew that there are many members of the chicory family that we regularly eat in salad.”

“Prebiotic dietary effects can be used to minimize the occurrence of enteric disease, thereby reducing the need to use antimicrobials,” says Lindberg. “This will improve animal productivity and welfare, and will also minimize the occurrence of contaminated products that can pose threats in the human food chain.” Lindberg also says that he would expect a similar response to these dietary changes in humans.

More information: H. Liu, E. Ivarsson, J. Dicksved, T. Lundh, and J.E. Lindberg, 2012. Inclusion of chicory (Cichorium intybus L.) in pigs’ diets affects the intestinal microenvironment and the gut microbiota. Appl. Environ. Microbiol. 78:4102-4109.)

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