

#158

Canola fibre: How to upcycle it into bioactive and beneficial prebiotic components?

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Background:

Due to the significant amount of non-starch polysaccharides (NSP) and glycoproteins, canola meal (CM) can be a valuable source of bioactive components which can be released with the use of multi-carbohydrase technology. These enzymatically-modified components, once metabolized by microorganisms in the gut, can modulate the composition and activity of the gut microbiota, thereby improving gut development, health, and function.

Objective:

The objective of this presentation is to summarize research on the enzymatically-modified CM fibre with the production of bioactive NSP hydrolysis products which may have prebiotic properties and exerted health benefits by improving the intestinal environment of poultry and swine.

Methods:

The advanced enzyme technology was used to develop a novel prebiotic containing products of enzymatically-modified CM fibre. The optimal composition of ingredient-specific carbohydrases to target NSP of CM was determined in vitro. Two types of enzymatically-modified CM products, ECM and its water-soluble fraction ECMS, were produced and evaluated for their chemical composition. Both products were used in the subsequent metabolic studies with broiler chickens, turkeys, laying hens and weaned piglets to assess their effects on microbiota population, production of SCFA, intestinal health status, nutrient digestibility, and growth performance. In studies with turkeys and laying hens, the birds were challenged with *Salmonella* Enteritidis.

Results:

In vitro evaluation of ingredient-specific carbohydrase preparations to target the NSP of CM was conducted and the most effective blend containing pectinase, xylanase, protease, and invertase was identified and led to depolymerization of 47.9% of NSP with the production of bioactive products (Niu *et al.*, 2022). When compared to CM, the ECM and ECMS products were rich in NSP hydrolysis products, and contained higher levels of protein, ash, phosphorus (P) and, as a result of the natural fermentation during the incubation process, were of low pH and contained appreciative amounts of lactic acid. No phytate P was detected. Supplementation of diets with ECMS improved growth performance and total SCFA in the ileal digesta of broilers. Canola meal derived bioactives improved nutrient digestibility, energy utilization and growth, decreased sialic acids (mucin) production, increased the presence of *Lactobacillus spp.* and *Enterococcus spp.*, SCFA contents, and decreased the abundance of *E. coli* in ileal and cecal digesta of poultry. Products demonstrated potential to reduce *Salmonella* cecal counts and excreta shedding in turkeys and laying hens. Dietary supplementation with CM prebiotics improved growth performance of turkeys infected with *Salmonella*, therefore mitigating the negative effects of challenge. Weaned pigs also benefited from CM prebiotic bioactives, as evidenced by a decrease in the pH of the colon contents and an increase in the population of beneficial *Bifidobacterium* species in the cecum and colon.

Conclusions:

Bioactive components enzymatically released from canola meal fibre can improve gut function and health and support the antibiotic-free feeding programs in monogastric animals.

Reference:

Niu, Y., Rogiewicz, A., Shi, L., Patterson, R., Slominski, B.A. (2022). The effect of multi-carbohydrase preparations on non-starch polysaccharides degradation and growth performance of broiler chickens fed diets containing high inclusion level of canola meal. *Anim. Feed Sci. Technol.*, 293: 115450. doi: 10.1016/j.anifeedsci.2022.115450.