Carbohydrate-degrading enzymes to restore gut health in broilers

Gut health problems cause big economic losses in poultry farming, especially since the EU banned the use of antibiotics as growth promoters in 2006. Carbohydrate-degrading multi-enzyme preparations (MEP) have emerged as a widely-used alternative, particularly in broilers fed cereal-based diets. Their mode of action is multifactorial, but is generally explained by the fact that they produce prebiotic oligosaccharides in the digestive tract.

► RESULTS

To better understand their mode of action, we isolated water-soluble polymer fractions from wheat grain incubated with and without MEP. The MEP increased the amount of short-chain arabinoxylans (SC-AX) without producing oligosaccharides.

These fractions were then incorporated into wheat-based diet to feed broilers for two weeks after hatching, and their effects on broiler performances, gut health, short-chain fatty acid production and gut microbiota composition were studied. The results showed that the presence of SC-AX in the feed significantly increases chick weight gain and promotes the growth of butyrate-producing bacteria (*Lachnospiraceae* and *Ruminococcaceae*). Gut inflammation was also decreased, which may be connected to the increase in butyrate, which is known to have anti-inflammatory effects and stimulate the enteroendocrine L-cells that produce gastrointestinal hormones needed for good broiler gut health. Here we demonstrated that the hydrolysis of polysaccharides does not need to be driven as hard as previously thought in order to produce active health-promoting compounds. With a degree of polymerization at around 50, the SC-AX effectively increased production of butyrate, decreased T-cell infiltration in the caecal and ileal mucosa, and increased L-cell density in the ileal epithelium—all of which are processes that signal improved gut health.

► FUTURE OUTLOOK

These results suggest that the beneficial action of MEP on animal performances is linked to the partial depolymerization of wheat-grain cell-wall polysaccharides. This same kind of study now needs to be extended to other crude feedstuffs to check whether other partly-degraded cell-wall polysaccharides reproduce the same effect.

Participants

This work was performed as part of doctoral research by Nadia Yacoubi (2014-2016), hosted within the Plant Cell Wall and Cell-Wall Polysaccharides team at the BIA unit under co-supervision with the Pathology, Bacteriology and Poultry Diseases department of Ghent University Faculty of Veterinary Medicine (Belgium).

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Read more

Water-soluble fractions obtained by enzymatic treatment of wheat grains promote short chain fatty acids production by broiler cecal microbiota
(2016) Animal Feed Science and Technology
Yacoubi N, Van Immerseel F, Ducatelle R, Rhayat L, Bonnin E, Saulnier L

Short-chain arabinoxylans prepared from enzymatically treated wheat grain exert prebiotic effects during the broiler starter period
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CONTACTS
Luc Saulnier
luc.saulnier@inra.fr
Estelle Bonnin
estelle.bonnin@inra.fr
Biopolymers, Interactions, Assemblies (BIA)