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Inulin-Type Fructans in Poultry Feed

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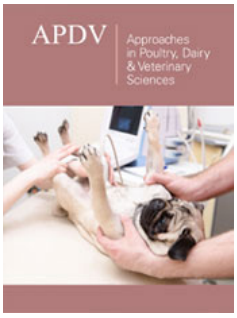

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Introduction

Fructans exist as a wide range of oligo- and polysaccharides in many species of bacteria, fungi, and plants [1]. They are classified into different families on the basis of their glycosidic linkages, consisting of (2→1)-linked β-D-fructofuranosyl units such as inulin, or (2→6)-linked β-D-fructofuranosyl units such as levans, or highly branched structures comprised of both (2→1)- and (2→6)-linked β-D-fructofuranosyl units such as graminans [2,3]. Among which, inulin-type fructans are perhaps by far the most widespread and researched current prebiotics.

The European Union has banned all in-feed use of antibiotics from 2006 and the use of antibiotics in feed is gradually reduced (or intense regulation) in other parts of the world. This perspective has stimulated nutritionists and feed manufacturers to search for new, safer alternatives. The primary alternatives studied include acidification of the feed by organic acids, feeding probiotic organisms and feeding prebiotic compounds.

In the 1980s, the possible potential effects of prebiotics in animal feeds was already recognized. Since then, the interest in the use of prebiotics in animal feeds has resulted in extensive research [4].

Unlike other carbohydrates, the inulin-type fructans are indigestible to mammalian enzymes [5], but may be fermented to produce lactic acid [6]. The non-digestible inulin-type fructans are found widely in many vegetable feed and food ingredients and are perhaps the best studied and documented prebiotics in domesticated animals [7].

At hatching, the gastrointestinal tract of broilers is sterile. Immediately, bacteria originating from the mother, the environment or the diet will colonise in the gastrointestinal tract. In case of mother contacts, a diverse microbial population will enter the gastrointestinal tract. As a result, after the first colonisation, bacterial species coming later in time will have greater difficulty colonising (colonisation resistance) than the initial population. Because of the strict separation of generations in broiler chickens, any bacteria from the environment might colonise (e.g. attach to intestinal binding sites or multiply faster than being removed via chyme passage) the intestinal tract. Those feed components that are resistant to enzymatic degradation, such as inulin-type fructans, serve as a substrate for bacterial activity in the intestinal lumen. The interaction between host nutrition and the intestinal microbiota has been clearly illustrated using germ-free animals. Langhout (1998) clearly showed the importance of controlling the activity of the intestinal microbiota to support gut integrity and to avoid

(i) bacterial overgrowth,

(ii) reduced nutrient digestibility and

(iii) reduced production performance [8].

Feeding inulin-type fructans may be a practical strategy for controlling pathogenic bacteria in chickens. Researchers summarised several experiments in which different types of fructans were fed to broilers alone or in combination with a probiotic to evaluate the effect on colonisation of pathogens (i.e. Salmonella spp. and Campylobacter jejuni) in caeca and on prechilled poultry carcasses [7,9-13]. Researchers concluded that supplementation of inulin-type fructans in combination with competitive exclusion flora may reduce colonisation by the pathogenic bacteria.

In order to effectively supplement inulin-type fructans in animal feed, additional research is also needed to elucidate the mode of action and the relationship between gut microflora, gut and animal health, and performance. Molecular DNA techniques might be helpful in research to gain further insight into the changes occurring in the composition of the gut microflora and the gene expression in gut tissue and relevant organs.

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