Effects of Dietary Fats on Diversity and Function of Cecal Microbiota in Broiler Chickens

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Diet has been found to impact the diversity and function of gut microbiota. Our study investigated the effect of dietary fat types on cecal microbial composition and predicted function in broilers at days 41 and 55 of age. We used shotgun metagenomic sequencing to evaluate the effects on these broiler cecal microbiota across four dietary fat sources compared to a control dietary fat source of poultry fat: two diets rich in omega-3 polyunsaturated fatty acids (PUFA) - fish oil and flaxseed oil, a diet rich in long chain saturated fatty acid (SFA) - lard, and a diet rich in medium chain saturated fatty acid - coconut oil. At day 55, broilers fed a PUFA-rich flaxseed oil diet exhibited significantly increased cecal microbial diversity and richness compared to the SFA-rich lard and coconut oil diets. More specifically, PUFA intake was associated with an enrichment of the bacterial families *Lachnospiraceae* and *Clostridiaceae* compared to SFA intake. Members of the *Lachnospiraceae* family play a critical role in gut health by producing short-chain fatty acids (SCFAs), which support gut barrier integrity, provide energy, and have anti-inflammatory effects. However, certain members of the *Clostridiaceae* family can be pathogenic and detrimental to the host. For pairwise comparisions between diets, fish oil supplementation when compared to the control enriched for *Bacteroides finegoldii, Bacteroides faecium,* and *Bacteroides luhongzhouii,* all of which are involved in carbohydrate breakdown, immune modulation, and short-chain fatty acid production. In general, however, predicted pathway and GO term abundances found for cecal microbiota showed a greater range of specific association with those chickens fed SFA-rich diets (lard and coconut oil) than for those chickens fed PUFA-rich diets (fish and flaxseed oil) when compared to the control, suggesting a functionally distinct impact of SFA on the gut environment. Together, our findings highlight the contrasting effect of SFA and PUFA fat type on cecal microbiota and a general potential for modulating host health and phenotype.