Effects of Probiotic on Fat Deposition, Serum Lipids and Cholesterol in Broilers

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Introduction

In view of the growing evidence of the dangers to public health from the widespread use of antibiotics, many countries, such as the US, the European Union and Japan have banned or severely restricted the use of antibiotics as a growth-promoter in animal feeds. Probiotics, which include *Lactobacillus* cultures, have been introduced as an alternative to antibiotics. Probiotics are biopreparations containing living micro-organisms that optimise the colonisation and composition of gut microflora in animals and have a stimulative effect on digestive processes and the immunity of the host. They also have a cholesterol-reducing effect on the host.

One of the major objectives of the poultry industry is to produce lean poultry meat to meet demands of consumers who are increasingly concerned with the nutritional quality of their food. Modern broilers have been reported to contain higher amounts of abdominal fat than those in the 1960s (1). Although there are several methods to remove fat and cholesterol in foods, most of the methods usually remove nutritional components of the food as well. Excess fat in broilers is also an economic burden to the poultry producers as more feed is consumed to produce fat, and furthermore, excess fat increases waste management problems. A the previous study has shown that supplementation of *Lactobacillus*-probiotic in broiler diets significantly lowered the serum total cholesterol (2). The present study was conducted to evaluate the effects of *Lactobacillus*-probiotic on the abdominal fat deposition, serum total cholesterol and lipids, and cholesterol and fat concentrations in liver and carcass of broilers.

Materials and Methods

The probiotic used consisted of a mixture of 12 *Lactobacillus* strains. The *Lactobacillus* strains and the method of preparing the strains as a probiotic feed supplement were the same as those described by Jin *et al.* (3, 4).

One hundred and twenty 1-day-old male broiler chicks (Avian 43) were assigned randomly to 8 cages of 15 chicks each. The chicks were divided into two dietary treatment groups (4 cages per treatment). The dietary treatments were: (i) a basal diet (control), and (ii) a basal diet + 0.1% *Lactobacillus*-probiotic. The experimental period was 42 days. At the end of the experimental period, severing the jugular vein and their abdominal fat, serum total cholesterol and lipids euthanised two birds selected randomly from each cage, and cholesterol and fat concentrations in the liver and carcass analysed. Total cholesterol, triglyceride, high-density lipoprotein cholesterol (HDL) ("good cholesterol"), low-density lipoprotein cholesterol (LDL) ("bad cholesterol"), and very low-density lipoprotein cholesterol (VLDL) ("bad cholesterol") concentrations in the serum were determined using commercially available reagent kits (Sigma). Tissue samples were extracted with chloroform-methanol (2:1, v/v) and the total cholesterol was determined using o-phthalaldehyde. Fat was determined by continuous extraction with petroleum ether in a Soxhlet apparatus. Abdominal fat was expressed as the percentage of total body weight.

Results and Discussion

The serum total cholesterol level was significantly ($P<0.05$) lower in broilers supplemented with *Lactobacillus*-probiotic (135.65 mg/dL) when compared to the control group (148.28 mg/dL). Broilers fed *Lactobacillus*-probiotic had significantly ($P<0.05$) higher serum HDL level (93.49 mg/dL), but significantly ($P<0.05$) lower serum LDL, VLDL and triglyceride levels (30.79 mg/dL, 11.37 mg/dL and 56.83 mg/dL, respectively) than control broilers (HDL, 79.39 mg/dL; LDL, 52.61 mg/dL; VLDL, 16.29 mg/dL; triglyceride, 81.44 mg/dL). Similar results were reported in rats and chickens by other workers (5, 6). The total cholesterol levels of the liver and carcass (8.11mg/g dry matter and 1.93 mg/g dry matter, respectively) were also significantly ($p<.05$) lower in *Lactobacillus*-probiotic-fed broilers as compared to control broilers (9.14 mg/g dry matter and 2.67 mg/ g dry matter respectively). These results indicated that the *Lactobacillus*-probiotic has a hypocholesterolemic effect on the chickens. The *Lactobacillus* strains used in the present study have been found to be able to assimilate cholesterol (7) as well as produce bile salt hydrolase enzyme (8) which deconjugates bile salts resulting in the co-precipitation of the deconjugated bile salts and cholesterol, which is then excreted in the faeces. *Lactobacillus* strains are also known to have the ability to interfere with the enterohepatic cycle.

Abdominal fat deposition and fat concentrations in the liver and carcass (2.01% of body weight, 10.35mg/g dry matter and 34.24 mg/g dry matter, respectively) were significantly ($P<0.05$) lower in *Lactobacillus*-probiotic-fed broilers than in control broilers (2.43% of body weight, 12.99mg/g dry matter and 37.33 mg/g dry matter respectively). It was reported that probiotics decrease fatty acid synthesis in the liver of broilers (9), which is an important factor in the triacylglycerol lowering effect (10).

Conclusions

The multi-strain *Lactobacillus*-probiotic was able to significantly re-

duce abdominal fat deposition, total cholesterol and fat concentrations in the liver and carcass, and serum total cholesterol and lipids of broilers.

Benefits from the study

The study showed that the *Lactobacillus*-probiotic, used as a feed supplement, could produce broiler chickens with less fat and lower cholesterol. This would not only produce economic benefits to the poultry industry but also health benefits to society as a whole.

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Graduate Research

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