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Effect of supplementation of various levels of inulin on meat and serum cholesterol in raja ii broilers

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Abstract

The present study was conducted at Department of Poultry Science, Veterinary College, Hebbal, Bangalore during April, 2016. The effect of feeding various levels of inulin on the meat and serum cholesterol in Raja II broiler chickens was studied. An experiment of 42 days duration was conducted with a flock of 225 day old straight run Raja II broiler chicks were selected randomly and out of this 45 chicks were assigned randomly to each treatments: control (without inulin), control + 0.25 percent inulin (T₂), control + 0.5 percent inulin (T₃), control + 0.75 percent inulin (T₄) and control +1 percent inulin (T₅). At the end of experiment the supplementation of various levels of inulin in broiler diets did not show any significant difference in meat cholesterol which ranges from 48.43±0.36, 48.54±0.19, 48.02±0.15, 48.11±0.15 and 48.50±0.31 in T₁ to T₅, respectively. The Serum cholesterol, TG, LDL, VLDL, HDL also not show any significant difference among the different treatment. The results indicated that inulin have a no effect on meat and serum cholesterol.

Keywords: broiler, inulin, cholesterol, meat and serum

1. Introduction

Prebiotics (e.g. fructans including inulin-type fructans (inulin and fructooligosaccharides) are nondigestible food ingredients, whose beneficial effects on the host result from the selective stimulation of growth and/or activity of members of the gut microbiota, specifically bifidobacteria and lactobacteria [1]. Inulin, generally extracted from chicory roots (*Cichorium intybus* L.), is a prebiotic formed by a chain of fructose molecules connected by β-(2–1) glycosidic bonds, terminated by one glucose molecule, which is not decomposed by digestive enzymes due to its chemical structure [2]. Fructans supplementation is known to produce positive influences both on health and growth; they increase intestinal growth relative to whole body weight, potentially enhancing nutrient absorption [3-4]; in broilers, a decrease in body fat deposition [9], serum cholesterol concentration. inulin-type fructans can alter lipid metabolism by reducing plasma triglyceride and cholesterol concentrations [10-11] in several animal models and in birds. The hypolipemic properties of inulin are caused by several mechanisms, of which the most important rely on indirect changes in the synthesis of hepatic triacylglycerols, VLDL secretion and the reverse absorption of bile acids [12].

Furthermore, the addition of inulin, resulting in a higher number of commensal bacteria in the large intestine, means that the fermentation of non-digestible carbohydrates in the small intestine leads to an increased concentration of SCFA in the colon, which in turn can cause a decrease in the concentration of blood lipids [12]. This decrease occurs through the inhibition of cholesterol synthesis in the liver and its redistribution from plasma into this organ. In addition, there is the possibility to reduce the absorption of cholesterol by deconjugation of bile acids by certain bacteria [12]. Deconjugation involves the disconnection of the taurine or glycine from a bile acid molecule, which impairs the absorption of cholesterol [12]. The objectives of the present studies was to assess the effects of various levels of inulin on meat and serum cholesterol in Raja II broilers.

2. Materials and methods

The present study was conducted at Department of Poultry Science, Veterinary College, Hebbal, Bangalore during April, 2016. A total of 225 day old straight run Raja II broiler chicks were wing banded, weighed and randomly assigned to five treatment groups with three

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replicates in each treatment group and with 15 chicks in each replicate consisting of five dietary treatments: control (without inulin), control + 0.25 percent inulin (T₂), control + 0.5 percent inulin (T₃), control + 0.75 percent inulin (T₄) and control +1 percent inulin (T₅). The chicks were reared under deep litter system with all standard managerial practices till 6 weeks of age. Standard vaccination schedule were followed for immunizing the chicks. Birds were fed with broiler pre starter diet (0-7 days), starter diet (8-21 days) and finisher diet (22-42 days). The basal diet was formulated as per the specifications of BIS-2007.

Inulin sample required for the trial was procured from Quadragen Vet health Private Limited, Bangalore. The randomly selected 45 birds were slaughtered at the end of the experiment for evaluating biochemical parameters like meat cholesterol and serum cholesterol, TG, LDL, HDL and VLDL.

2.1. Broiler meat cholesterol

The cholesterol content in the meat was estimated as follows: The total lipid from the meat sample was isolated as per the procedure outlined by [5]. Approximately two g of meat sample was homogenized with 10 volume of folch solution (chloroform: methanol 2:1) for three min and allowed to stand at room temperature for one hr. The mixture was filtered through Whatman filter paper No.1. The filtrate was evaporated to dryness and 10 ml of 0.9 percent sodium chloride solution was added and allowed to stand at the room temperature for one hr which led to the separation of two layers. The top layer was discarded and the bottom layer containing lipid and chloroform was evaporated to dryness. The dried residue was reconstituted with five ml chloroform. The cholesterol content in the lipid extract was estimated by the one step method of [6]. To five ml of cholesterol reagent (ferric perchlorate, ethyl acetate and concentrated sulphuric acid), 50µl cholesterol standard (200 mg cholesterol per 100 ml glacial acetic acid) or lipid extract was added, mixed well, kept in boiling water bath for 15 min. Tubes were immediately cooled and the absorbance was read at 560 nm against blank using UV- visible spectrophotometer.

$$\text{Cholesterol mg /100 g meat} = \frac{\text{OD of sample} \times 200 \times 5}{\text{OD of standard} \times 100 \times \text{Sample wt}} \times 100$$

2.2. Serum cholesterol, TG, LDL, VLDL, HDL

The blood samples were collected from jugular vein of three birds selected randomly from each replicate of all the treatment group at the end of 6 th week. Blood samples were allowed to clot at 4°C for 2 hrs and were then centrifuged, serum was separated individually and each treatment group for determining cholesterol, High-density lipoprotein (HDL) [6] and triglyceride [7]. Very low-density lipoprotein (VLDL) was determined by dividing triglyceride concentration to five. Low-density lipoprotein (LDL) calculated by subtracting HDL and VLDL from cholesterol concentration [8].

2.3. Statistical analysis

Data pertaining to various parameters obtained during the trial was analyzed statistically by ANOVA using SPSS 20 statistical software. Differences between the means were tested using Duncan's Multiple Range Test at P< 0.05.

3. Results and discussion

The results of the present study showed that there was no significant difference in meat cholesterol in groups supplemented with various levels of inulin when compared to control group (T₁) presented in Table 1. The present study results are in contrary with the finding of [9] who reported that addition of inulin (4-6 g/kg of diet) to broiler diets significantly decreased cholesterol concentration in meat. The lack of effect on meat cholesterol might be due to is an decrease in production of short chain fatty acid such as propionate, which is not able to interfere with liver metabolism in the liver.

The results of the present study showed that there was no significant difference in serum cholesterol, TG, LDL, VLDL, HDL in groups supplemented with various levels of inulin when compared to control group presented in Table 2 and in support with the previous reports of [13] who found non influence of 5 and 10 g/kg of inulin on serum cholesterol or LDL-cholesterol concentration in cobb broilers fed with diets containing two different source of fat for 35 days of age. Similar results were recorded by [14] also reported that supplementation of 4.5% chicory extract-inulin with ground wheat based diets in Ross broilers for 6 weeks of age showed no significant difference in total cholesterol, low-density lipoprotein-cholesterol(LDL) and high density lipoprotein-cholesterol(HDL). The results of the present experiment are in contrary with the finding of [15] also reported that supplementation of microencapsulated inulin oligosaccharide at the rate of 0.2 and 0.3 g/kg showed significant decrease in blood total cholesterol (by 9.41-9.85%) and triacylglycerols (by 11.75-13.45%) in Ross broiler at 5weeks of age. Similar results were recorded [16] reported that supplementation of 250 and 350 mg/kg Chicory extract in Ross 308 broilers for 6 weeks of age had significantly lower serum triglyceride, cholesterol and VLDL concentrations than other treatments.

The lack of effect might be due to decrease in lactic acid producing bacteria and hydrolase enzyme which fail to converts bile salts into deconjugated bile acid which lead to no effect on serum cholesterol level. Lack of fatty acid synthesis which may lead to no effect on serum triglycerides and lipoprotein level.

4. Conclusion

The present study reveals that supplementation of various levels of inulin in broiler diets did not show any significant difference in meat cholesterol and Serum cholesterol, TG, LDL, VLDL, HDL. So the results indicated that inulin have a no effect on meat and serum cholesterol.

Table 1: Effect of supplementation of inulin on Meat cholesterol level (mg/100g meat) of Raja II broilers

Experimental group	Description of the treatment	Meat cholesterol level (mg/100g meat)
T1	Control (without Inulin)	48.43±0.36
T2	Control + 0.25%Inulin	48.54±0.19
T3	Control + 0.5%Inulin	48.02±0.15
T4	Control+ 0.75% Inulin	48.11±0.15
T5	Control + 1% Inulin	48.50±0.31

Table 2: Effect of supplementation of inulin on Serum cholesterol, TG, LDL, VLDL and HDL values of Raja II broilers

Experimental group	Description of the treatment	Serum Cholesterol (mg/dl)	TG (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)	HDL (mg/dl)
T1	Control (without Inulin)	99.66±14.97	113.0 ±7.57	36.33±12.78	22.33±1.76	41.0±0.57
T2	Control + 0.25% Inulin	87.66±12.44	92.0±4.72	33.33±13.44	18.00±1.0	36.33±0.88
T3	Control + 0.5% Inulin	94.0±7.50	104.66±24.83	48.0±20.23	20.33±4.84	39.0±2.08
T4	Control+ 0.75% Inulin	100.0±5.56	113.0±19.34	39.0±7.0	22.0±4.04	39.0±6.55
T5	Control + 1% Inulin	104.33±2.02	108.0±7.63	42.67±3.84	21.0±1.52	40.66±1.76

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