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# Blood Cholesterol, LDL and HDL in Crossbred Local Chicken Feed Inulin of Dahlia Tubers as a Prebiotic

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**Abstract**

The feeding inulin of dahlia tubers as a prebiotic related to the quality of the resulting product is a product low cholesterol. The research was aimed to examine the role of inulin as a prebiotic derived from dahlia flower tuber in the form of powder and extract on blood cholesterol, low density lipoprotein (LDL) and high density lipoprotein (HDL) of crossbred local chicken. The research was assigned in a completely randomized design with 7 treatments and 4 replications (10 birds each), treatments applied were T0: basal ration, T1: ration + 0.4% powder of dahlia tuber, T2: ration + 0.8% powder of dahlia tuber, T3: ration + 1.2% powder of dahlia tuber, T4: ration + 0.39% extract of dahlia tuber, T5: ration + 0.78% extract of dahlia tuber, T6: ration + 1.17% extract of dahlia tuber. The birds were reared for conditioning from day 1 until 3 week, and dietary treatment was given thereafter until 11 week of age. Parameters observed were blood cholesterol, LDL and HDL. The data were statistically analyzed according to ANOVA and continued to Duncan test at the level of 5% probability. The results showed that feeding inulin in the form of powder or extract significantly (P<0,05) decreased LDL and HDL, but not on blood cholesterol. In conclusion, feeding inulin in the form of powder in 1.2% (T3) and extract in 1.17% (T6), able to reduce levels of LDL and HDL but not yet capable of lowering blood cholesterol of crossbred local chicken.

**Keywords**: crossbred local chicken, inulin of dahlia tuber, blood cholesterol, low density lipoprotein, high density lipoprotein.

## A. Introduction

Adult chicken meat demand is likely to increase. However, in reality the cultivation of chicken obstacles that growth is slower than broiler that has a short production period. Attempts to overcome these problems it has done poultry diversification through the development and cultivation of local chicken crosses a descendant among local male chicken with the female race. The local chicken crosses have relatively short production period so that more promising in supporting the poultry in Indonesia because it can be marketed at the age of 50-60 days.

Currently the community health awareness is increasing. People prefer foodstuffs of animal origin in particular poultry-fat and low cholesterol. Consumption of excess fat and cholesterol in humans, harmful to health as it can lead to atherosclerosis (clogged arteries). Recommended fat consumption as much as 15-30% of the total energy consumption and recommended cholesterol <300 mg daily (Almatsier, 2001). Cholesterol is found in the blood along with triglycerides, phospholipids and apoproteins to form lipoproteins. Lipoproteins in the blood are

chylomicrons, very low density lipoprotein (VLDL), low density lipoprotein (LDL), and high density lipoprotein (HDL) (Sacher et al., 2004). Blood cholesterol levels are high resulting in accumulation of cholesterol in the body.

Cholesterol levels can be affected by animal feed consumed. High fat in the diet will result in increased levels of low-density lipoprotein (LDL) in the blood that is rich lipoprotein cholesterol (Muhajir, 2002), so that the necessary efforts to make low-cholesterol animal products, namely the addition of inulin as a prebiotic. Inulin is classified as a food ingredient that is classified as a prebiotic and provides the best prebiotic effect than other prebiotics (Azhar, 2009). Chemical properties of inulin is soluble in water and cannot be digested by digestive enzymes, but can be fermented by the intestinal microbes. Giving the prebiotic inulin is known to increase the amount of lactic acid bacteria (LAB) so that conditions become more healthy digestive tract, which in turn provide beneficial effects for the host. In addition, administration of prebiotic inulin as closely linked with the quality of the product that is low-cholesterol products. Previous research by Yusrizal and Chen (2003) reported that administration of inulin from chicory root of 1% real lower blood cholesterol levels compared to the control treatment on the broiler. This study aims to assess the role of inulin as a prebiotic to cholesterol, LDL and HDL local chicken blood crosses.

## B. Methodology

*1. Materials*

Research using hybrid local chicken (chicken males with females laying hens) unsex, aged 22 days 280 tail with an average body weight of 180.46 ± 1.21 gram. The ration consists of yellow corn, rice bran, soybean meal, fish meal, vegetable oil, CaCO3, minerals, vitamins, flour and flowers dahlia tuber extract. Rations study prepared containing 19% protein and metabolizable energy of 2,800 kcal / kg for the period starter, and protein 17% with 2,800 kcal metabolizable energy / kg for finisher period (Table 1). Rations given treatment for 9 weeks of maintenance from 3 weeks to 11 weeks of age.

*2. Method*

Chickens reared for 11 weeks during the first 2 weeks chickens reared in cages litter. Age 3 weeks, chickens were weighed to obtain a uniform body weight and were moved to battery cages made of wire in accordance with the treatment and replications. Feeding starter performed at the age of 1 to 45 days and finisher feed is given at age 46 to 77 days. Inulin dahlia tuber extract powder and mixed into a little ration in the morning until consumed, followed by rationing without inulin accompanied adlibitum drinking water. Chickens were vaccinated Newcastle Disease (ND) at the age of 4 days and Gumboro vaccine at the age of 13 days to prevent disease.

**Table 1.Experimental Rations and Nutrient Content.**

| Feed Stuffs | Starter | Finisher |
|---|---|---|
| Yellow corn | 51,30 | 47.00 |
| bekatul | 15,00 | 25,00 |
| Soybean meal | 22.50 | 18.00 |
| Fish flour | 10,00 | 8.00 |
| $CaCO_3$ | 0.70 | 1.20 |
| Vitamins and Minerals | 0.50 | 0.80 |
| Total | **100.00** | **100.00** |
| The content of nutrients: | | |
| Metabolic energy (kcal / kg) * | 2821.89 | 2872.80 |
| Crude Protein (%) ** | 19.46 | 17.56 |
| Crude Fat (%) ** | 4.99 | 5.75 |
| Crude Fiber (%) ** | 4.81 | 5,94 |
| Methionine (%) *** | 0.44 | 0.39 |
| Lysine (%) *** | 1.26 | 1.08 |
| Arginine (%) *** | 1.39 | 1.23 |
| Calcium (%) ** | 1.02 | 1.01 |
| Phosphorus (%) ** | 0.66 | 0.64 |

Source:
*)Based on calculations (Hartadi et al., 2005).
**) Analyzed proximate in Nutrition and Feed Science Laboratory, Faculty of Animal Husbandry and Agriculture, Diponegoro University (2014).
***) Based on Table NRC (1994).

*3. Treatment design*

The study used a completely randomized design (CRD) with 7 treatments and 4 replications, so that a total of 28 experimental units. Each test or experimental unit consisted of 10 chickens so that the overall amount of chicken as many as 280 birds. The treatments consisted of: T0 = ration without addition of flour and extracts of dahlia tubers, T1 = + 0.4% ration dahlia tuber flour, T2 = ration + 0.8% dahlia tuber flour, T3 = ration + 1.2% starch tubers dahlia, T4 = ration + 0.39% dahlia tuber extract, T5 = ration + 0.78% dahlia tuber extract, T6 = ration + 1.17% dahlia tuber extract. Parameter research includes blood cholesterol, LDL and HDL blood. Blood sampling performed at the end of the study as many as 1 whole chicken on each experimental unit. Blood samples were taken from the brachial veins in the wings as much as ± 3 cc then analyzed to determine the levels of cholesterol, HDL and LDL in the Laboratory of Clinical Pathology, Faculty of Veterinary Medicine, University of GadjahMada. Data analysis of variance (ANOVA) with F test at 5% level. If there is a real effect, followed by Duncan test (Steel &Torrie, 1991).

## C. Result and Discussion

The mean blood cholesterol, LDL and HDL from application of starch and inulin extract dahlia tubers are presented in Table 2. The results of variance analysis showed that the source of inulin from dahlia tubers form of powder or extract significant (P <0.05) cholesterol levels and a blood HDL, but not on blood cholesterol levels.

**Table 2.Blood cholesterol, LDL and HDL on Local Chicken Crosses.**

| Treatment dahlia tubers | Blood cholesterol (mg/dl) | LDL (mg/dl) | HDL (mg/dl) |
|---|---|---|---|
| T0 | 136.50 ± 19.64 | 37.01 ± 9.35 $^{a}$ | 80.84 ± 17.70 $^{b}$ |
| T1 | 127.76 ± 14.34 | 32.51 ± 2.79 $^{ab}$ | 99.82 ± 14.23 $^{ab}$ |
| T2 | 122.17 ± 23.90 | 21.73 ± 14.67 $^{c}$ | 106.38 ± 19.10 $^{ab}$ |
| T3 | 125.83 ± 15.80 | 26.77 ± 6.52 $^{bc}$ | 105.13 ± 15.44 $^{ab}$ |
| T4 | 124.73 ± 19.03 | 30.52 ± 6.56 $^{abc}$ | 92.10 ± 13.93 $^{ab}$ |
| T5 | 124.99 ± 10.64 | 23.96 ± 6.50 $^{bc}$ | 93.24 ± 6.55 $^{ab}$ |
| T6 | 123.06 ± 9.22 | 21.06 ± 2.49 $^{c}$ | 107.05 ± 15.56 $^{a}$ |

Different superscripts in the same column indicate significant differences P <0.05. Description: T0: The ration without flour and extracts of dahlia tubers, T1: Rations + 0.4% dahlia tuber flour, T2: Rations + 0.8% dahlia tuber flour, T3: Rations + 1.2% dahlia tuber flour, T4: rations + 0.39% dahlia tuber extract, T5: + 0.78% ration dahlia tuber extract, T6: + 1.17% ration dahlia tuber extract.

Treatment with the addition of inulin extract 1.17% (T6), produce high levels of LDL are markedly lower than T0 and T1, however, between the treatment T2, T3, T5 and T6 no different. On the other hand, HDL levels were significantly higher in T6 than T0, between the other treatments (T1 T2, T3, T4 and T5) showed similar values (Table 2).

Total blood cholesterol shows no significant effect (P> 0.05) but, numerically showed slightly lower as a result of treatment inulin dahlia tubers either powder or extract compared to the control treatment. This happens because inulin is a carbohydrate that is not digested by the host animal nonruminant, but can be fermented by microbes prebiotic digestive tract become a sort of chain fatty acid (SCFA) in the form of acetate, propionate and butyrate. Sort chain fatty acids are then absorbed and metabolized in the hearts and involved in the regulation of lipid and sugar (Heavy and Rowland, 2004). Lipid regulation process can be explained that propionate finish HMG CoA reductase which is a catalyst mevalonic acid formation of beta hydroxy beta metylglutaryl CoA. Mevalonic acid is a precursor of cholesterol. Thereby inhibiting the formation of cholesterol propionate (Kaur and Gupta, 2002). The metabolism of the above is supported by the data Fanani (not yet published), of propionic acid increased from 3.60 mMol / l (T0), 5.65 mMol / l (T3) up to 6.37 mMol / l (T6). The results of this study are supported by the findings of Velasco et. al. (2010), that the addition of inulin to the diet has a beneficial effect on blood cholesterol by reducing the concentration triasilgliserida in broilers.

Treatment with the provision of the highest inulin, are able to provide more fiber material to be fermented microbial digestive tract so that it can produce a high SCFA, especially acetate, propionate apart. Fanani's research results (data not published) show that SCFA, especially acetate increased from 14.66 mMol / l at T0 be 24.38 mMol / l at T6, also led to a decrease in pH in the digestive tract of 6.10 and 5.45 at T0 T6 (Krismiyanto, unpublished). The second component of the metabolite could inhibit the growth of pathogenic bacteria and instead increase the number of BAL. The BAL Improved support increased enzyme bile salt hydrolase (BSH), which related in lowering blood cholesterol. In the opinion of Surono (2004), that inulin is known to increase the growth of LAB have a mechanism in lowering cholesterol by producing enzymes BSH that produce bile acids deconjugated (compounds that do not react with other compounds), in the form of cholic acid-free which is poorly absorbed by the gut smooth. The bile acids to form bile salts.Deconjugation bile salts easier wasted through feces resulting in more cholesterol is needed so that cholesterol in serum bile salts used to form again, which in turn causes serum cholesterol levels in the blood decrease. Furthermore, Hartoyo et al. (2005) states that hearted attempt to secrete bile acids to replace the lost with excreta.

The mechanism supported LDL levels were significantly lower as a result of the provision of inulin tubers of dahlias form of powder or extract compared with controls, whereas an increase in HDL cholesterol due to administration of inulin tubers of dahlias than in controls. Increasing HDL levels showed that there is a response from the treatment that is given, as Hartini and Okid (2009) states that high levels of HDL prevents the risk of occurrence of atheroklerosis by means transports cholesterol from peripheral tissues to the liver and reduces excess cholesterol. According to Murray et al., (1996) Molecular HDL lipoproteins are small relative to the other so that HDL can pass through vascular endothelial cells and into the intima to transport of cholesterol accumulated in the macrophages, besides HDL also have antioxidant properties that may help prevent the oxidation of LDL.

The above phenomenon has implications for chicken products in relation to cholesterol reduction. Tannock (1999) reported that the cholesterol-lowering mechanism known as BAL can be coprostanol degrade cholesterol, a sterol that cannot be absorbed by the intestine. Furthermore, coprostanol and the rest of the cholesterol issued together with the feces. Thus, the amount of cholesterol is absorbed by the body to be low.

LDL and HDL are two types of lipoproteins that function circulate in the blood so kosentrasinya cholesterol in the blood is influenced by the amount of cholesterol synthesized (Hasanuddin, 2013). Montgomery et al. (1993) suggests that LDL cholesterol plays a role in providing the body tissues for a major career for cholesterol from the liver to body tissues, so that the levels of LDL in the blood is influenced by the concentration of cholesterol. On the other hand, HDL is a lipoprotein that maintains the balance of cholesterol in order not to accumulate inside the cell, the balance is managed by the transport of sterols of the membrane at a rate equal to the amount of cholesterol is synthesized to the liver (Diestchy, 2003).

## D. Conclusion

Provision of inulin in the form of flour to 1.2% (T3) and extract up to 1.17% (T6) can lower blood levels of LDL and HDL, but less capable of lowering blood cholesterol local chicken crosses.

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