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Effect of Acidifier and Turmeric (*Curcuma domestica*) in Feed on Quality of Broiler Meat

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Abstract**—** *Research on the addition of acidifier and turmeric (Curcuma domestica) in broiler feed aims to observe the effect on broiler meat quality. The materials used in this study were 240 DOCs of Cobb strain without sex differentiation (unsex). Broilers were reared for 35 days. The DOC used had an average weight of 40.55±1.69 g/bird with a coefficient of variation of 4.16%. The research method used was an in vivo experiment with 6 treatments and 4 replications. Each replication used 10 broiler chicks. The treatments used consisted of P0(basal feed +0% acidifier + 0% turmeric powder), P1(basal feed + 2% turmeric powder), P2(basal feed +0.5% acidifier + 1.5% turmeric powder), P3(basal feed +1% acidifier + 1% turmeric powder), P4(basal feed +1.5% acidifier + 0.5% turmeric powder), and P5(basal feed +2% acidifier). The variables observed were meat fat and meat cholesterol levels. The results showed that the addition of acidifier and turmeric powder in broiler feed had no significant effect (P>0.05) on meat fat but very significant effect on meat cholesterol (P<0.01). The conclusion of the study was the addition of acidifier and turmeric powder in broiler feed with a dose of 2% acidifier and 0% turmeric powder gave the best results in terms of reducing meat cholesterol.*

Keywords**—** *Acidifier, turmeric powder, fat, cholesterol, broiler*.

I. Introduction

Broilers are one of the livestock commodities that play a significant role in meeting the needs of animal protein in the country. Broilers are a type of poultry that has a fairly rapid growth rate because broilers can be harvested at the age of 35 days with an average harvest weight of 1.7-2.0 kg/bird. The genetic advantages possessed by broilers can display high production performance. Broilers are characterized by large, fatty bodies, fast growth rates, and produce meat with high protein content.

An important consideration in meat quality is the high fat and cholesterol content of the meat. The rapid growth of broilers is also followed by the growth of fat. This high fat content leads to high cholesterol levels in the body of the chicken which is not preferred by consumers. High cholesterol levels can cause atherosclerosis in humans which eventually leads to coronary heart disease. Currently, the poultry industry is trying to produce broilers with meat that is low in both fat and cholesterol levels.

Efforts to improving broiler fat and cholesterol levels are by the use of feed additives. Feed additives in the form of antibiotics have been widely used by farmers to increase feed use efficiency, increase production and maintain health. The addition of antibiotics for animal feed additives since May 2017 has been prohibited as stated in article 16 paragraph 2 of the Indonesian Minister of Agriculture number 14/ PERMENTAN/ PK.350/ 5/ 2017 concerning the classification of veterinary drugs. Residual use of antibiotics in poultry products can cause resistance in the body of livestock and unfavorable risks to human health when consuming these products. One alternative that can be done is to replace antibiotics with natural antibiotics derived from acidifiers and herbs.

Acidifiers are feed additives added to feed or drinking water to increase digestibility through metabolism in the body by increasing the performance of digestive enzymes, lowering the pH in the gut, and maintaining microbial balance in the digestive tract. Acidic conditions in the digestive tract will stimulate the secretion of bile salts to neutralize the pH which has an impact on lowering cholesterol [1].

Turmeric which contains curcumin has the potential as an anti-inflammatory and antioxidant. [2] explained that the use of turmeric powder can actually reduce cholesterol content because curcumin is useful as an anti-inflammatory and antioxidant [3].

The combination of acidifier with turmeric added in broiler feed has not been widely studied. Acidic conditions in the digestive tract will stimulate the secretion of bile salts to neutralize the pH which has an impact on lowering cholesterol. Turmeric, which contains curcumin, has the potential to act as an anti-inflammatory and antioxidant, while acidifiers increase digestibility by lowering the pH in the gut.

II. Material and Methods

The field research was conducted at Mr. Amir's broiler farm on Jalan Perum Citra Pesona Buring Raya Blok D1 Malang City, while samples analysis for fat and cholesterol were done in Food Quality and Safety Testing Laboratory of Brawijaya University, and Biomedical Laboratory of Muhammadiyah University of Malang. The material used in this study was day-old broilers. The broilers used were Cobb strain broilers produced by Charoen Pokhpand with the production code CP707. The 240 chicks which were raised from the age of 1-35 days without differentiating sex (unsex) were distributed to 6 treatments and 4 replicates. Each experimental unit was filled with 10 broilers.

This study used commercial feed from the animal feed company, Japfa Comfeed Indonesia, Tbk. The feed used has the same quality as the standard broiler feed requirements for both starter and finisher phase feed which can be seen in Table I.

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TABLE I. Basal Feed Nutritional contents

Nutrient Content	BR I	BR II
Water content	Maks. 12.00%	Maks. 12.00%
Ash	Maks. 7.00%	Maks. 8.00%
Crude protein	Min. 21.00%	Min. 19.00%
Crude fat	Min. 5.00%	Min. 5.-0%
Crude fiber	Maks.5.00%	Maks.6.00%
Calcium	0.80-1.10%	0,80 – 1.10%
Phosphor	Min. 0.50%	Min. 0.45%

Source: PT. Japfa Comfeed Indonesia Tbk.

The research method used is an experiment designed with a Completely Randomized Design (CRD) consisting of 6 treatments and 4 replicates. The treatments were as follows:
T0 = Basal feed + 0% *acidifier* + 0% turmeric powder
T1 = Basal feed + 0% *acidifier* + 2% turmeric powder
T2 = Basal feed + 0.5% *acidifier* + 1.5% turmeric powder
T3 = Basal feed + 1% *acidifier* + 1% turmeric powder
T4 = Basal feed + 1.5% *acidifier* + 0.5% turmeric powder
T5 = Basal feed + 2% *acidifier* + 0% turmeric powder

Acidifier wss obtained from animal feed stores with the trade name PROS ACID G produced by Better Pharma Co., Ltd. The composition of PROS ACID G in 1 kg contains formic acid 350.00 g, lactic acid 58.00 g, propionic acid 78.00 g, citric acid 99.50 g, silicon dioxide 18.50 g, and carrier q.s up to 1.00 kg.

Turmeric powder made from the powder of the rhizomes of the turmeric plant produced by Materia Medika, Batu, East Java. Turmeric powder was sieved using a 60 mesh before use. The sieved turmeric powder was specially analyzed for curcumin content at LPPT Gajah Mada University. Curcumin in turmeric powder used during the study contained 4.49% curcumin.

Collection of sample data were done by taking breast meat. Meat sampling was carried out on each experimental unit by taking 1 representative broiler aged 35 days to be slaughtered. Meat sampling begins by separating the chest for the process of separating the meat from the bones (fillet). The breast meat was weighed as much as 50 g for the meat cholesterol test and 50 g for the meat fat test. The meats were put into plastic clips and labeled, transferred into an ice box before being taken to the laboratory until being analyzed.

The variables observed were:

a). Meat fat content analysis

Meat fat content was analyzed using the soxhlet extraction method. Fat percentage was calculated using the formula. The meat fat calculation formula uses the following formula [4].

$$\text{Percentage of fat (\%)} = \frac{W1-W2}{W} x\ 100\%$$

Description:
W1 = Filter paper after oven 1
W2 = Filter Paper after oven 2
W = Sample Weight

b). Meat cholesterol level analysis

The meat cholesterol test was conducted using the modification method of Dr. David Sleighton [5]. The cholesterol content in the sample was obtained by comparing the absorbance value of the sample with the standard. The formula for calculating meat cholesterol uses the following formula [6].

$$\text{Meat cholesterol (mg/100g)} = \frac{A1}{A2} x \frac{B}{C} x\ 100\%$$

Description:
A1 = Absorbance of sample
A2 = Standard absorbance
B = Standard cholesterol
C = Weight of sample

The data obtained were then tabulated and analyzed by analysis of variance (ANOVA) using the Excel program. If the treatment has a significant or highly significant effect, then it is continued with Duncan's New Multiple Range Test.

III. Results And Discussions

Data on the average meat fat and cholesterol content of 35-day-old broiler meat during the study are presented in Table II.

TABLE II. The effect of treatment on the meat fat and cholesterol content

Treatments	Variable	
	Meat fat (%)	Meat cholesterol (mg/100g) **
T0	0.99±0.36	254.13 ±127^{b}
T1	1.36±0.78	121.10 ±7,.5^{ab}
T2	1.30±0.51	127.52 ±29.63^{ab}
T3	1.06±0.34	83.49 ±15.86^{a}
T4	1.25±0.15	65.14 ±16.07^{a}
T5	1.40±0.70	45.87 ±14.09^{a}

***different superscript at the same column indicated highly significant effect (P<0.01)*

1. Effect of Treatment on Meat fat content

Fat in the body has important functions as a body protector from low temperatures, a vitamin solvent, a protector of vital body organs, and as an energy reserve. The results of statistical analysis showed that the addition of acidifier and turmeric powder in broiler feed gave no significant difference in effect (P>0.05) on broiler meat fat. The percentage of meat fat in this study is still lower than according to [7]. The level of each chemical content of meat depends on the type of breed, age, and sex of the chicken concerned, even in the same broiler meat, each component can vary from one part to another. The chemical content of chicken meat consists of 65-80% water, 16-22% protein, 1.5-13% fat, carbohydrates and non-nitrogenous substances 0.5-1.5%, 1% organic constituents and small amounts of vitamins [7].

The result of no significant effect may be due to the fact that body fat is more influenced by hormonal factors. The speed of triacylglycerol synthesis is influenced by the performance of several hormones such as insulin, increasing the process of converting carbohydrates into triacylglycerol in the body. Wahjuni [8] explained that the biosynthesis of long-chain fatty acids is influenced by hormones. Insulin stimulates biosynthesis, while glucagon spurs phosphorylation (deactivation) in fatty acid biosynthesis.

2. Effect of Treatments on Meat cholesterol level

The results of statistical analysis showed that the addition of acidifier and turmeric powder in broiler feed in each treatment gave a very significant difference effect (P <0.01) on meat cholesterol levels. The lowest meat cholesterol level was broiler

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treated with 2% acidifier which amounted to 45.87 ± 14.09 mg/100g while the highest meat cholesterol level was broiler untreated which amounted to 254.13 ± 127 mg/100g in control group.

The growth and development period of broilers requires cholesterol as a constituent of cell membranes, as a component in the formation of steroid hormones (cortisol, estrogen and testosterone), and is needed for the development of nerve tissue and brain tissue, especially at an early age [9]. Cholesterol in the blood comes from two sources, namely exogenous from consumed feed and endogenous synthesized by the liver. Cholesterol is absorbed from the intestine and combined in chylomicrons formed in the mucosa, after chylomicrons release triglycerides in adipose tissue, the remaining chylomicrons carry cholesterol into the liver. Feed containing high cholesterol causes a buildup of molecules in the liver. These accumulated cholesterol molecules will be distributed throughout the body.

An increased amount of cholesterol can cause atherosclerosis, which is the accumulation of cholesterol in the walls of blood vessels that causes clotting, causing blockages in blood vessels in human. This means that it is recommended to consume low cholesterol broiler meats. Al-Najdawi and Abdullah [10] stated that cholesterol in skinless broiler meat ranges from 133-202 mg/100gr based on dry weight. The results showed that the average total cholesterol of broilers was 116.21 ± 35 mg/100g. Broiler cholesterol increased when the percentage of acidifier given was reduced.

Giving acidifier with levels up to 0.5% has not been able to reduce meat cholesterol but increasing the level to 1% to 2% acidifier can significantly reduce meat cholesterol levels. Acidifier plays a role in supporting the development and growth of beneficial microbes, such as *Lactobacillus sp* and *Bacillus sp* bacteria and suppressing pathogenic microbes such as *Salmonella enteritidis* and *Escherichia coli* bacteria so that it has an impact on the health of the digestive tract. According to [11] acidifiers can improve the function of the digestive tract in digesting and absorbing nutrients, especially protein so that the performance of broilers is maintained. Acidifiers used in research contain formic acid, lactic acid, propionic acid, citric acid and silica dioxide. Giving citric acid in feed and drinking water can reduce meat and blood fat levels [12]. Low pH conditions will make the atmosphere in the intestine acidic. Acidic conditions in the digestive tract will stimulate the secretion of bile salts by cholesterol to neutralize the pH so that less cholesterol is deposited into the meat. Kurniagung et al [1] explained that the administration of citric acid can cause the intestine to be at pH 5 and make the atmosphere of the digestive tract acidic. Acidic conditions in the digestive tract will stimulate the secretion of bile salts to neutralize pH. Bile secreted in the liver will use cholesterol in the blood as an ingredient to form bile. The use of cholesterol in the blood results in less cholesterol being deposited into the tissues (meat). This causes the low cholesterol of meat produced with the addition of citric acid. The acidifier used in this study also contains propionic acid which can reduce cholesterol levels. According to [13] propionic acid can reduce cholesterol levels by inhibiting the action of the enzyme β hydroxy-β methyl glutamyl CoA (HMG-CoA) reductase which plays a role in cholesterol synthesis. Propionic acid inhibits the incorporation of acetate into plasma cholesterol by competing with the acetic acid transporter to hepatocyte cells. This will result in a decrease in cholesterol synthesis because acetate is a precursor in cholesterol formation.

Broilers that were only given 2% turmeric contained meat cholesterol of 121.10 ± 7.35 mg/100g. This value is lower when compared to the treatment without acidifier and turmeric powder. This is in line with [14] who explained that the addition of turmeric juice (*Curcuma domestica* Val) with a level of 2% in hybrid ducks can increase the percentage of carcasses and reduce the cholesterol content of duck thigh meat. Turmeric contains active compounds, namely curcuminoids and essential oils, both compounds have cholagogue activity. The effect of cholagogue is to secrete bile by increasing the total bile acids that will be released into the duodenum, so that cholesterol synthesis can be reduced. Turmeric can improve the work of the digestive organs, stimulating the release of pancreatic amylase, lipase and protease enzymes. Another content contained in turmeric is curcuminoids which can increase appetite which in turn will increase the live weight of chickens [15]. Nurtamin [3] added that curcumin can reduce cholesterol levels by inhibiting the reabsorption of cholesterol from outside (exogenous) and increasing the enzyme HMG-CoA reductase inhibitor.

IV. Conclusion

The addition of acidifier and turmeric powder (*Curcuma domestica*) in the feed has not been able to reduce fat breast meat, however the dose of 2% acidifier and 0% turmeric powder can largely reduce breast meat cholesterol levels.

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