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by Dadik Pantaya

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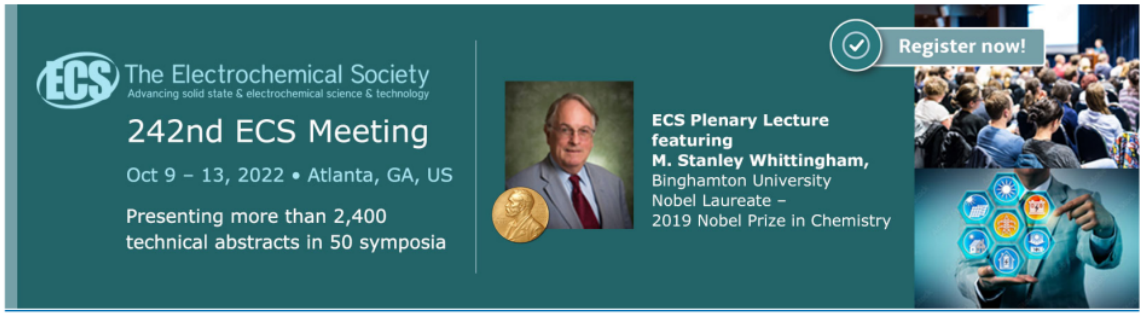

Addition garlic extract in ration on fat deposition of broiler

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Abstract. This research was conducted to determine the effect of garlic extract on the fat deposition of the broiler. The experimental design used Completely Randomized Design with four treatments, each treatment has of five replications and each replication consist of four broilers. The data using analysis of variance and when there were have significant differences, then further tested by Duncan New Multiple Range Test. The treatments were T0 (without garlic extract), T1 (2%), T2 (4), and T3 (6%). The treatments were started from 15 to 35 days of age. Parameters observed included: feed intake, weight gain, feed conversion, carcass weight, carcass percentage, abdominal fat weight, and abdominal fat percentage. The results showed that the addition of garlic extract did not affect (P>0.05) to feed consumption. The addition 2% of garlic extract in ration had a significant effect on body weight and feed conversion while addition 4% of garlic extract in ration decreased (P<0.01) abdominal fat weight, abdominal fat percentage, and increased carcass weight P<0.05) and percentage of the carcass (P<0.01).

1. Introduction

The Food Agriculture Organization estimates that demand for livestock production has doubled and produced more than half the total value of world agricultural production. Then by 2020, it is assumed that there will be a revolution in the field of animal husbandry (the next food revolution), namely 60% of meat production will be produced by developing countries, including Indonesia.

The broiler is one source of animal protein that is many consumed by Indonesian people. in the tropics area has high temperature and humidity, so broilers can be stress which the response of the environment adaptation. According to [1] broiler in the tropics can be stress which the responses of the environment. Adaptation responses can disturb the metabolism process. The energy consumed cannot be converted to be meat maximally and can impact of high abdominal fat. The addition of natural ingredients can be acted to increase the body weight, the feed conversion, and to decrease the abdominal fat.

The addition of natural ingredients can increase the body weight, the feed conversion, and to decrease the abdominal fat. Garlic (*Allium sativum* L) is used as an herbal supplement because based on research that has been conducted on experimental animals, the content of organosulfur compounds prevents cancer [2] [3]. Garlic supplements have been widely used in the world [4].

Garlic is a perennial herbaceous plant that forms a layer bulb, grows in clumps and stands up to 30 to 75 cm tall. The stem that appears on the ground is a false stem, the true stem is in the ground. From the base of the stem grow many fibers with a length of less than 10 cm. Garlic forms a layer bulb, each

tuber consists of 8 to 35 cloves [5]. Each garlic bulbs contains 100 gram such as 4.5 grams of protein; 0.2 grams of fat; 23.1 grams of carbohydrates; calories around 95 calories; 0.22 mg of vitamin B1; 1.5 mg of vitamin C; calcium 42 mg; phosphorus 134 mg; iron 1 mg and water around 71 g. In percentage conversion, the nutrient content is as follows: carbohydrates 28%, protein 2%, crude fiber 1.5%, organosulfur compounds 2.3% and water content 65% [6].

Garlic contains more than 100 secondary metabolites [7]. Secondary metabolites contained in garlic form a complex chemical system and are a self-defense mechanism from damage caused by microorganisms and other external factors [8]. These secondary metabolite compounds contain sulfur and influence the taste and pharmacological properties of garlic [9]. The main organosulfur compounds with garlic tubers are non-volatile amino acids glutamyl-S-L-cysteine and essential oils of cysteine sulfoxide or alliin. The compound is a precursor to most other organosulfur compounds, reaching 82% of all organosulfur compounds [10]. The glutamyl-S-L-cysteine compound is formed from the amino acid biosynthesis pathway. The enzymatic reactions that occur from glutamyl-S-L-cysteine produce many derivative compounds, through two branches of reaction, namely S-all cysteine (SAC) forming pathways [11]. From the thiosulfinate formation pathway allicin compounds will be produced, then from this pathway will be formed allyl sulfide, dithiin, ajoene, and other sulfur compounds. Allicin is unstable [8] so it is easy to further reactions to organosulfur compounds [12]. Extraction of garlic with ethanol at a temperature below 0° C produces alliin, at 25° C produces allicin and at a temperature of 100° C by steam distillation method all the alliin content changes to allil sulfide [13]. Fresh garlic contains 2 to 6 mg per g of gamma-glutamyl-S-allyl cysteine or 0.2 to 0.6% of fresh weight and 6 to 14 mg per g of alliin or 0.6 to 1.4% of fresh weight. Furthermore, garlic extract contains 2500 to 4500 mcg/g of allicin from fresh weight before being cut, so that if made on average, one garlic contains 2 to 4 g of allicin [14].

Allicin can increase the conversion feeding so the broiler has a low fat abdominal and high meat production. Organosulfur is able to increase the meat production. Allicin and organosulfur can be found in garlic [15] and garlic contains a variety of organosulfur complexes, such as ajoene, S-allyl cysteine, S-allyl cysteine sulfoxide, diallyl disulfide, and S-methyl cysteine sulfoxide. Allicin as an antimicrobial agent. Allium sativum also contains approximately 100 sulfur compounds that are fundamentally pharmacological potential [16]. Scordinin helps the metabolism process and increase the sulfur of amino acid as methionine. Methionine is an essential amino acid to muscle tissue of broiler [17]. Garlic has to contain allicin, it was expected to improve the broiler performance.

The aim of this research to know the effect of garlic extract on broiler performance. The benefits of this research are giving the information about the effect garlic extract in the feed of broiler performance. Besides the use of fresh garlic, currently, there are some garlic preparations, namely garlic powder, garlic oil, and garlic extract. Garlic extract in ethanol with a concentration of 15 to 20% can be stored for about 20 months at room temperature and produce aged garlic extract [18]. In the form of extracts, garlic can be stored for up to 20 months. In garlic extract all allicin is converted to allyl sulfide, according to the percentage, diallyl trisulfide (DTS), diallyl disulfide (DDS) and diallyl sulfide (DS) [19].

2. Materials and Methods

2.1 Preparation of Garlic Extract

250 grams of garlic mashed using a juicer and then mixed with 500ml of 96% ethanol. The solution was filtered with 2 layers of gauzy, then filtered again with Whatman paper number 2 so obtained crude extract. The filtrate on the Erlenmeyer tube and placed in a water bath to evaporate ethanol until got 100 ml of garlic extract.

2.2 Birds and Treatments

The experimental arrangement was using a completely randomized design. Eighty Day Old Chick (DOC) were randomly divided into four treatments, each treatment consists of five replications and each replication consist of four chickens. Treatment T0 or control group received a basal feed with 21-

22% protein content and metabolic energy 2800-3000 Kcal/Kg without supplementation of garlic extract while T1, T2, and T3 were basal feed supplemented with 2%, 4%, and 6% garlic extract. The treatments were started from 15 to 35 days of age. The concentration of garlic extract through this process was 280 mg/mL. On the 1st day until the 14th days of age, the chicken was fed basal feed without supplementation of garlic extract. Feed supplemented with garlic extract was given at 3-5 weeks of age. Water and feed provided by ad-libitum.

2.3 Research Parameters

Feed intake was measured daily during the research. Feed consumption can be calculated by finding the difference between the amount of feed in one day with the rest of the feed that existed on the next morning. Weight gain was weighed every week during the research. The weight gain is measured by calculating the difference between the final weight and the initial weight. Feed conversion calculated weekly during the study. Conversion of feed is the ratio between the amount of feed consumed in one week with weight gain in one week. Carcass weight in this research comes from carcass without head, neck, fur, blood, legs and internal organ. The percentage of the carcass was calculated after the carcass weight obtained. The percentage of the carcass was calculated by weight of carcass divided by live weight and multiplied 100% [20]. The abdominal fat weight calculated by the fat found around the gizzard and the layers attached between the abdominal and bowel muscle. Abdominal fat percentage by calculating the weight of abdominal fat divided by body weight multiplied by 100%.

2.4 Data analysis

Data obtained from the results of this study were analyzed with analysis of variance (ANOVA) using Statistical Product for Service Solution program (SPSS 16.0). Results of analysis showing significant mean differences were continued by Duncan Multiple Range Test.

3. Results and Discussion

The research of the broiler performance from 3rd to 5th week included: feed consumption, body weight, feed conversion, carcass weight, carcass percentage, abdominal fat weight, the abdominal fat percentage can be seen in Table 1. Side effects and toxicity of garlic are not found so that they are safe for consumption. Safety of using garlic extract based on several studies has been recommended [8] there has been no reported toxicity of organosulfur compounds of garlic extract.

Table 1. Effect of garlic extract on broilers

Parameters	Treatments			
	T0	T1	T2	T3
Feed Consumption	3218,40^{ns}	3045,20^{ns}	3182,40^{ns}	3154,40^{ns}
Body Weight Gain	1443,00^{a}	1649,80^{c}	1596,00^{b}	1588,00^{b}
Feed Conversion	2,23^{c}	1,85^{a}	1,99^{b}	1,99^{b}
Carcass weight	1098,00^{a}	1179,00^{bc}	1202,00^{c}	1107,00^{ab}
Abdominal fat weight	29,40^{a}	27,55^{a}	24,00^{b}	28,25^{a}
Abdominal fat percentage	1,84^{a}	1,63^{bc}	1,47^{c}	1,78^{ab}
Carcass Percentage	68,60^{a}	69,95^{a}	73,21^{b}	70,49^{a}

^{ns} Nonsignificant

The analysis variance of the feed consumption showed that the addition on garlic extract in the feed broiler is not significantly (P> 0,05) on feed consumption. According to [1] showed that the addition on garlic extract is not significantly on feed consumption, it is because broiler needs energy, feed consumption will increase when the broiler consumed feed of low energy and consumption will decrease when the broiler consumed feed of high energy and report of [21] the broiler needed 3200 Kcal energy metabolism. The broiler consumed the same energy, so there is a no different influence in each treatment.

Addition of garlic extract in ration was significantly effected (P <0,01) on body weight of broiler. All compounds and enzymes contained in garlic were able to provide value to the metabolic system in the broiler. When the metabolism system in good condition, the absorption of feed consumption become the body weight can be optimal. Proteins have a function in building organs and tissues and providing amino acids. Although the research showed that protein did not give an effect on feed consumption, protein and energy given significantly on the body weight gain broiler, because of the content in garlic extract helped the process of feed absorption on the broiler [22].

The research showed that garlic extract had significantly effect on the feed conversion (P <0,01) because of energy and protein in the feed that contains extract of garlic is absorbed optimally. Allicin that showed antimicrobial is able to avoid the body from the pathogenic bacterial infection, methylatyltrisulfide prevent blood coagulation. Antimicrobial activity in garlic is caused by allicin and ajoene compounds [23]. Ajoene, an organosulfur compound found in onion oil, inhibits the growth of gram positive and negative bacteria [24]. A good metabolism process will give a good absorption process, so the value of feed conversion was low. The percentage of using garlic extract as much as 2% gives efficiently feed conversion than other treatments [25]. The percentage of addition garlic extract as much as 2% showed the best research on the feed conversion of the broiler. Addition garlic extract in the ration can increase the antibacterial activity in allicin, it can damage the intestinal mucosa and inhibit protein synthesis. When the intestinal mucosa is damaged and protein synthesis is inhibited it will decrease the metabolism system, the absorption of feed was not optimally, the body weight is low and the value of feed conversion ratio was high.

The result of supplementation of garlic extract in ration increased carcass weight. The result of the different test of carcass weight of T0 (control) was lowest (P <0,05) than T1, T2, and T3. Garlic extract contains bioactive diallyl sulfide (DAS) and diallyl disulfide (DADS). Diallyl sulfide (DAS) and diallyl disulfide (DADS) can increase the availability of amino acids containing sulfur, including methionine which is an essential amino acid that functions for muscle tissue growth. According to [26] methionine can increase the muscle mass of breast through the way of synthesizing creatine from methionine and then kept on muscle so that increased muscle mass. The increased muscle period will cause the flesh to increase so that the carcass weight was higher than control.

The percentage of carcasses in this research ranged from 68.60% to 73.21%. The result of variance analysis showed that the addition of garlic extract in ration increased the percentage of carcass significantly. The data is correlated with data on average carcass weight and abdominal fat weight data. The weight of carcass from highest to the lowest was T2, T1, T3, and T0, respectively, whereas abdominal fat weight from highest to lowest was T0, T3, T1, and T2, respectively. These data indicate that a high percentage of carcass obtained from high carcass weight and low abdominal fat weight.

Addition of garlic extract in ration significantly decreased abdominal fat. The result of the difference test of the mean of the lowest abdominal fat weight of T2 (P <0,01) compared to T0, T1, and T3. Garlic extract contains Allicin which has the binding properties of the functional part of Co-A while Co-A needs for cholesterol biosynthesis. Allicin in the gastrointestinal tract results in intestinal mucosal peeling, this condition triggers low digestive pH and suppresses cholesterol synthesis enzyme activity ie 3-hydroxy-3-methylglutaryl CoA reductase (HMGCo-A reductase) enzyme. This is in accordance with opinion [27] the addition of garlic significantly reduces the activity of HMG-A reductase. The decrease in HMG CoA reductase activity causes the amount of Co-A to decrease. Reduced Acetyl-CoA results in the obstruction of the lipogenesis process. According to [28] fat is formed from the conversion of intermediates, such as acetyl Co-A. Acetyl Co-A produced by metabolism process will enter into the citric acid cycle so that energy is produced, if energy requirement is sufficient, acetyl Co-A can experience lipogenesis to fatty acid and then esterified into triglyceride. The inhibited lipogenesis caused the transfused fats to the adipose tissue decreased so that abdominal fat decreases. Garlic extract supplementation in animal feed effectively decreases 15% cholesterol concentration and 30% LDL compared to controls [15]. Allicin is able to bind to the organosulfur group which is a functional part of co-enzyme A in the cholesterol formation process. Allicin and allyl mercaptan inhibit the HMGCo-A reductase enzyme and lanosterol accumulation [29].

Blocking activity of HMGCo-A reductase enzyme are indications of the absence of cholesterol synthesis and at the same time inhibit mevalonate [30]

The results of the analysis of variance performed showed that the addition of garlic extract in the ration decreased the abdominal fat percentage significantly. The average difference test of abdominal fat percentage on T0 (control) was highest (P <0,05) compared to T1, T2, and T3. The low percentage of abdominal fat in this study was obtained from the low abdominal fat weight. It shows the ability of bioactive allicin inhibits the process of lipogenesis in the body resulting in the decline in fat deposits. Less abdominal fat causes lower abdominal fat percentage. The abdominal fat percentage shows the number of parts of broiler that is not consumed by a human, so the greater the percentage of abdominal fat, the lower the quality of broiler.

4. Conclusion

Addition of garlic extract did not affect (P>0.05) to feed consumption, 2% of garlic extract had a significant effect on body weight and feed conversion while 4% of garlic extract decreased (P<0.01) abdominal fat weight, abdominal fat percentage, but increased carcass weight (P<0.05) and percentage of carcass (P <0.01).

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