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Effect of Black Garlic and Temulawak (*Curcuma zanthorrhiza* Roxb) Addition on Carcass and Abdominal Fat of Broilers Chickens

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ABSTRACT

The purpose of this study was to evaluate the addition of black garlic & *Curcuma zanthorrhiza* Roxb on broiler carcass and abdominal fat. A completely randomized design (CRD) was conducted with five treatments and four replications. Each replication consisted of 10 chickens and a total of 200 broilers was used. The broilers were randomly allocated into 20 unit of cages. The feeding treatments were P0 = 100% commercial feed without black garlic powder (BGP) and curcuma powder (CP) addition as a feeding control, P1 = P0 + 3% BGP + 0% TP, P2 = P0 + 2% BGP + 1% TP, P3 = P0 + 1% BGP + 2% TP, and P4 = P0 + 0% BGP + 3% TP. The measured variables were feed consumption, slaughtered weight, carcass weight, and abdominal fat percentage. Analysis of variance (ANOVA) was used to analyze the data and the significant result was tested with Duncan's multiple range test to determine whether the treatment had a significant effect. According to the results of this study, the utilization of black garlic and curcuma in broiler diets was not significantly different in all variables. It was concluded that the usage of black garlic and curcuma did not increase carcass weight and abdominal fat in broilers.

Key words: abdominal fat, black garlic, broiler, carcass, *Curcuma zanthorrhiza* Roxb

INTRODUCTION

Carcass quality can be seen from the abdominal fat formed in broilers, the high content of abdominal fat indicates the high inter-muscle fat content and meat cholesterol. Abdominal fat measurement can be used as an indicator of total body fat. Abdominal fat weight tends to increase with age in broiler chickens. Abdominal fat accumulation will affect carcass weight (Salam *et al*. 2013). The need for quality chicken meat is increasing along with the increasing public knowledge of the importance of health. This causes a high demand for meat that is low in fat and low in cholesterol. Efforts that can be made to improve carcass quality include the use of feed additives. Natural ingredients that can be used as additional feed are garlic and temulawak.

Garlic (*Allium sativum*) contains *allicin* and *scordinin* which belong to the essential oil group (Amagase, 2006). The results of the research by Syakir *et al*. (2017) proved that giving garlic as much as 3 mg/bird/day resulted in a carcass percentage of 70.29%. Where the value of carcass weight in broilers is affected by live weight and ration consumption, the higher the live weight, the higher the carcass weight produced (Nurhayati *et al.* 2010). Raeesi *et al.* (2010) stated that garlic can increase the ability of enzymes involved in bile acid fluid to remove cholesterol, resulting in a decrease in fat in body tissues. According to Ashayerizadeh *et al.* (2009) the use of 1 kg of garlic powder in 1 ton of feed in broilers can significantly increase carcasses with low abdominal fat compared to controls. An increase in carcass weight and a decrease in abdominal fat in broiler chickens can occur with the addition of garlic at the level of 0.5, 1 and 3% in the feed (Raeesi *et al.*2010), but the use of garlic is constrained because of the very sharp aroma and unpleasant taste. It is necessary to do additional processing, one of which is by fermentation / heating into black garlic.

Black garlic contains compounds that have a better pharmacological effect than garlic, because the fermentation process can increase the compounds in black garlic (Sasaki *et al.* 2007). Wang *et al*. (2010) stated that heating garlic causes the distinctive aroma of garlic to be lost. Nelwida *et al.* (2019) stated that fresh garlic heated for 17 days at 60ºC produced a more balanced nutrient content than heating for more or less than 17 days. The use of black garlic in feed up to a level of 3% has an effect on quail growth, but has no effect on quail feed consumption (Berliana *et al*. 2018). Therefore, the use of black garlic needs to be combined with other additional feeds that can improve feed consumption so that feed efficiency can be achieved. Materials that can be used include temulawak.

Temulawak (*Curcuma xanthorrhiza Roxb*.) is an herbal plant that contains essential oils and curcuminoids. Both of these compounds act as feed additives both biologically and pharmacologically in livestock by increasing the productivity, quality, and health of livestock. The results of Jumiati *et al.* (2017) proved that an increase in carcass weight in broiler chickens could be achieved by using 1% and 2% temulawak in feed. Jumiati *et al*. (2017) proved that giving temulawak flour at a level of 1-3% in feed can reduce abdominal fat in broiler chickens aged 5 weeks. The low content of abdominal fat indicates that the condition of the carcass produced is better (Massolo *et al.* 2016). The use of temulawak powder in the feed is expected to facilitate digestion and accumulation of body fat so that the growth of broiler chickens becomes better and is able to produce an optimal carcass percentage with low abdominal fat. The use of black garlic and temulawak in feed is expected to improve digestion and reduce the accumulation of body shellac so that the growth of broiler chickens will be better. Increased growth will

Table 1 The composition and nutritional content of the basal diet, black garlic and temulawak

Compositions	Temulawak[a]	Black garlic[b]	Starter diets	Finisher diets
Dry matter (%)	94.14	31.94	88	88
Protein (%)	9.88	15.66	20	19
Fat (%)	9.04	3.57	5	5
Fiber (%)	2.26	3.07	5	6
Ash (%)	4.62	4.03	8	8
Curcumin (%)	2			
Xanthorrhizol (%)	1.58			
Essential oil (%)	5.97			
Starch (%)	53			
EM (kkal kg^{-1})	312	1019	2900	2900

a. Rukmana (1995); b. Berliana *et al.* (2018); c. PT.Indojaya Agrinusa (2019)

Table 2 The composition and nutritional content of the diet treatment on starter phase

Komponen	P0	P1	P2	P3	P4
Dry matter (%)	88	86.37	86.97	87.57	88.18
Crude protein (%)	20	19.87	19.82	19.76	19.71
Crude fat (%)	5	4.96	5.01	5.06	5.12
Crude fiber (%)	5	4.94	4.94	4.93	4.92
Ash (%)	8	7.88	7.89	7.90	7.90
Curcumin (%)	0	0	0.02	0.04	0.06
Xanthorrhizol (%)	0	0	0.02	0.03	0.05
Essential oil (%)	0	0	0.06	0.12	0.17
Starch (%)	0	0	0.51	1.03	1,54
EM (kkal kg^{-1})	2900	2845.21	2838.35	2831.49	2824.62

P0 = 100% commercial feed without black garlic powder (BGP) and temulawak powder (TP) as a control, P1 = P0 + 3% BGP + 0% TP, P2 = P0 + 2% BGP + 1% TP, P3 = P0 + 1% BGP + 2% TP, and P4 = P0 + 0% BGP + 3% TP

result in higher body weight and high carcass weight with low abdominal fat.

Based on the description above, this research was conducted with the aim of knowing the effect of using black garlic and temulawak alone or a combination of both on carcass weight and abdominal fat of broiler chickens.

METHODS

Birds and Dietary Treatments

This study used two hundred broiler chicks which were reared for 35 days in a colony cage measuring 100cm x 100 cm x 70 cm. Feed and drinking water are provided *ad libitum*. A completely randomized design with 5 treatments and 4 replications, with 10 chicks per replication, was used. Treatments were P0 = 100% commercial feed without black garlic powder (BGP) and temulawak powder (TP) as a control, P1 = P0 + 3% BGP + 0% TP, P2 = P0 + 2% BGP + 1% TP, P3 = P0 + 1% BGP + 2% TP, and P4 = P0 + 0% BGP + 3% TP. Commercial feed is categorized into three types based on age: pre-starter phase feed (1-7 days), starter phase feed (8-21 days), and finisher phase feed (22-35 days). The composition and nutritional content of the basal diet, composition and nutritional content of the diet treatment starter phase are presented in Table 2. The composition and nutritional content of the diet treatment *finisher phase* are presented in Table 3.

Experimental Bird Management

The processing of black garlic powder was carried out according to the instructions of Berliana *et al.* (2018) where garlic is heated in magicom at 60°C for 17 days, then dried in an oven at 60°C for 24 hours, after drying it is ground into flour and mixed in feed according to treatment. The preparation of temulawak powder was carried out according to Dono (2010) instructions. Temulawak powder was prepared from fresh ingredients which were thinly sliced and then dried. Slices of fresh material are dried in indirect sunlight for 2-3 days. After drying, it is ground into flour and then mixed in the feed according to the treatment. From one day to 35 days old, chicks from a local breeder were given dietary treatments. Throughout the study, the animals were given free access to food and water. 20 chicks were slaughtered, de-feathered, and eviscerated on day 35. The abdominal fat was extracted and weighed right away. The carcass and abdominal fat were assessed (in % of live body weight).

Table 3 The composition and nutritional content of the diet treatment on finisher phase

Komponen	P0	P1	P2	P3	P4
Dry matter (%)	88	86.37	86.97	87.57	88.18
Crude protein (%)	19	18.90	18.85	18.79	18.73
Crude fat (%)	5	4.96	5.01	5.06	5.12
Crude fiber (%)	6	5.91	5.91	5.90	5.89
Ash (%)	8	7.88	7.89	7.90	7.90
Curcumin (%)	0	0	0.02	0.04	0.06
Xanthorrhizol (%)	0	0	0.02	0.03	0.05
Essential oil (%)	0	0	0.06	0.12	0.17
Starch (%)	0	0	0.53	1.03	1.54
EM (kkal kg^{-1})	2900	2845.21	2838.35	2831.49	2824.62

P0 = 100% commercial feed without black garlic powder (BGP) and temulawak powder (TP) as a control, P1 = P0 + 3% BGP + 0% TP, P2 = P0 + 2% BGP + 1% TP, P3 = P0 + 1% BGP + 2% TP, and P4 = P0 + 0% BGP + 3% TP

black garlic, and temulawak are presented in Table 1. The

Table 4 Average feed consumption, slaughter weight, percentage of carcass and percentage of abdominal fat of broiler chickens

Parameters	P0	P1	P2	P3	P4
Feed consumption (g bird^{-1}week^{-1})	450.06±16.07	472.47±23.41	476.47±12.25	479.15±19.79	490.04±23.53
Slaughtered weight (g bird^{-1})	1283.50±43.38	1283.00±8.57	1284.00±46.35	1286.75±46.21	1270.75± 43.71
Carcass (%)	72.40±0.59	72.87±2.26	73.46±1.85	72.37±1.01	72.59±4.49
Abdominal fat (%)	1.78±0.20	1.67±0.16	1.64±0.19	1.78±0.20	1.76±0.21

P0 = 100% commercial feed without black garlic powder (BGP) and temulawak powder (TP) as a control, P1 = P0 + 3% BGP + 0% TP, P2 = P0 + 2% BGP + 1% TP, P3 = P0 + 1% BGP + 2% TP, and P4 = P0 + 0% BGP + 3% TP

Statistical Analysis

ANOVA was used to analyze data on carcass and abdominal fat using a Completely Randomized Design. Duncan's multiple range test was used to look for significant differences between treatment groups. A significant level of $p< 0.05$ was used.

RESULTS AND DISCUSSION

The effect of using black garlic powder and temulawak powder in broiler feed consumption, slaughter weight, carcass and abdominal fat can be seen in Table 4.

The results showed that the treatments had no significant effect on the consumption of broiler feed. This was presumably because the nutritional content of the treatment feed was relatively the same. This can be interpreted that adding black garlic and temulawak powder until level 3% can be tolerated by broilers. Changes in smell and taste due to the addition of garlic powder and ginger in the feed did not affect palatability so did not make a significant impact on feed consumption of broilers. Besides that addition of black garlic and temulawak powder in the feed in a slightly not very large percentage changes the nutritional composition of the feed so that it is not significant to feed consumption, because one factor that affects ration consumption is the nutritional content of feed. In addition, the absence of treatment effect on feed consumption may also be due to the addition of black garlic and temulawak alone or a combination of both in the feed does not affect palatability so that consumption is not disturbed. According to Situmorang *et al*. (2013) feed palatability is strongly influenced by taste, aroma and color. The average rate of feed consumption in this study ranged from 450.06 - 490.04 g bird^{-1} week^{-1}. The results of this study are in line with the results of the research of Berliana *et al*. (2018) which proves that the use of 3% black garlic powder does not affect the consumption of quail feed.

The treatments had no significant effect on the slaughter weight of broiler chickens. The average slaughter weight in this study ranged from 1283.00 – 1286.75 grams head^{-1}, this value is lower than the results obtained by Dono (2010), namely the addition of 2% garlic powder and 2% temulawak powder seems to give a slight increase, slaughter weights were 1551 and 1491 grams head^{-1}. The addition of black garlic and temulawak alone or a combination of the two in the feed did not affect the slaughter weight of broiler chickens, presumably because the feed consumption in all treatments was not different, so it did not affect the resulting slaughter weight.

The results showed that the use of black garlic powder and temulawak powder had no significant effect on the percentage of broiler carcasses. This shows that the growth of meat tissue in all treatments using black garlic and temulawak alone or in a combination of the two in the feed is relatively the same. In addition, it is also suspected that the slaughter weights produced for each treatment are relatively the same. This is probably caused by the content and quality of the rations consumed relatively the same, thus producing relatively equal body weight gain in the end produces a percentage of carcasses which is almost the same. Supported by the opinion of Soeparno (2005) which states that slaughter weight is one of the factors that affect the percentage of broiler carcasses. The average carcass percentage obtained in this study ranged from 72.37% - 73.46%. This result is higher when compared to Nurhayati *et al*. (2010) which resulted in relative carcass weight ranging from 65.5% - 68.61% (average 67.28%).

The results showed that the treatments had no significant effect on the percentage of abdominal fat in broiler chickens. This is probably caused by the content of active compounds in black garlic and temulawak does not work optimally in breaking down fat components in the broiler's body. So it is necessary to test the effectiveness of the active compound content in its role in breaking down body fat so that it can significantly reduce abdominal fat content. Based on the data in Table 4, the average percentage of abdominal fat produced was 1.64% - 1.78%, while Mide (2008) study which used temulawak in the feed produced higher abdominal fat, namely 2.31% - 2.63%. The lower levels of abdominal fat in this study were thought to be due to the role of allicin in black garlic which can bind endogenous bile salts, so that the formation of fat emulsions is inhibited as a result of decreased fat absorption in the body. This situation was caused by the allicin compound containing sulfur which is able to shed fat (Syamsiah & Tajuddin, 2004). In

addition, it is also suspected that the effect of curcumin compounds in temulawak can stimulate the bile wall to secrete bile which plays a role in fat breakdown (Wijayakusuma, 2005). Supported by Jumiati *et al.* (2017) which proves that a decrease in abdominal fat in broilers can occur by giving 1-3% temulawak flour in the feed.

CONCLUSION

It was concluded that using black garlic and temulawak alone or in combination in feed had no effect on broiler chicken carcass weight or abdominal fat. Chicken ration with 2% black garlic and 1% curcuma is recommended for use by commercial broiler chicken farms because it produces a higher percentage of carcasses and a lower percentage of abdominal fat than other treatments.

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