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Utilization of *Cassia alata* L. Leaf Extract in Feed on Carcass and Physical Quality of Broiler Meat

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Abstract**—** *This research aimed to evaluate the extract of Cassia alata L. leaf which was used as a feed additive on the carcass and the physical quality of meat in broilers. The materials used in this study were 200 broiler day old chicks. Broilers were kept for 35 days. The method was an experiment. Data were analyzed by using analysis of variance (ANOVA) if there were differences between treatments followed by Duncan's Multiple Range Test. The treatments were PO (-): commercial feed (control feed), PO(+): commercial feed + 0.1% tetracycline, P1: treatment commercial feed +0.4% extract, P2: commercial feed + 0 ,8% extract, and P3: commercial feed + 1.2% extract. The variables measured were carcass weight, breast percentage, and abdominal fat, and physical quality including cooking loss, water holding capacity, and tenderness. The results showed that the use of Cassia alata L. leaf extract had no significant effect (P>0.05) on the carcass quality of broilers. The treatments had a significant effect (P<0.05) on cooking loss and water holding capacity, but it did not have a significant effect (P>0, 05) on meat tenderness of broilers. This study concluded that the use of leaf extract of Cassia alata L. as a feed additive as much as 0.8% in feed is the best concentration that might improve carcass quality of broiler meat.*

Keywords— *Cassia alata L., extract, antibiotics, carcass quality, broilers.*

I. Introduction

The broiler population in Indonesia in 2019 increased was more than 3.2 billion but decreased in 2020 to 3.0 billion due to the covid-19 pandemic [1]. The key to the success of a broiler farming business is influenced by three main factors, namely the provision of a superior breed, good quality of feed, and good management practice. Feed contributes the highest production cost, almost 70%, and is one of the main factors determining success in the broiler business. While feed additive is commonly added to improve the performance of broiler, the prohibition use of Antibiotic Growth Promoter (AGP) makes alternative use of feed additive products becomes apparent.

Feed additives in the form of adding antibiotics to feed have been widely used by farmers to increase feed efficiency [2], increase production and maintain livestock health [3]. According to Iwantoro [4], the negative impacts on human health due to antibiotics residues from livestock products are allergic reactions, toxicity, and resistance to microorganisms. Many countries refuse animal food originating from livestock given synthetic antibiotics. Antibiotic residues in livestock products can cause resistance of intestinal microbes. One alternative that can be done is to replace antibiotics by using feed additives named phytobiotics in broiler feed.

Cassia alata L. contains active compounds which have an antimicrobial effect proposed to replace antibiotics. According to Nurul *et al.*, [5] *Cassia alata* L. leaves contained some natural active substances consisting of alkaloids, saponins, flavonoids, carbohydrates, tannins, triterpenoids, and anthraquinone derivatives. The results of the study by Kusmardi et al. [6] explained that *Cassia alata* L. plant has the potential to stimulate an immune response. Extracts from the leaves were carried out with several solvents and with various techniques which showed the presence of antimicrobial and antioxidant activities. Regarding the presence of bioactive content, antibacterial and antioxidant activity is supported by extraction technology. The current research aimed to evaluate the use of *Cassia alata* L. leaf extract on the carcass quality of broiler meat.

II. Material Methods

Time and Location

This research was carried out for 35 days starting from August - September 2021 at the Tholabie Islamic Boarding School in Buring Village, Kedungkandang District, Malang Regency. The extraction of *Cassia alata* L leaf was carried out at the Laboratory of Nutrition and Animal Feed, Faculty of Animal Husbandry, Brawijaya University, Malang Regency. The proximate analysis was carried out at the Central Laboratory, University of Muhammadiyah Malang. The *cooking loss*, WHC, and tenderness analysis were conducted at the Laboratory of Food Quality and Safety, Faculty of Agricultural Product Technology, Universitas Brawijaya, Malang Regency.

Broiler

The materials used in this study were 200 unsex day old chick (DOC) broiler strain Cobb CP 707 produced by PT Charoen Pokphand Indonesia Tbk., *Cassia alata* L. leaf extract. The broiler chicks were placed in 20 plots, and the coefficient of variation was 5.93%.

Cages and Cage Equipment

The cage used was a cage with a litter system with 5 treatments and each treatment was repeated 4 times, so the number of experimental units was 20 with 10 chickens in each replication. Each unit area was 1 m x 1 m, was equipped with a feeder and drinking facilities. The feed used in this study was commercial feed produced from PT Charoen Pokphand, namely CP-11, 511 and CP12 G for, starter, grower, and finisher feed,

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respectively. Provision of rations and drinking water was provided *ad libitum* during the study period.

Cassia alata L. Leaf Extract

The collected fresh leaves samples of *Cassia alata* L. leaves was then cleaned with running water, then dry at room temperature for 24 hours. Then drying processed was continued in an oven at 45°C for 36 hours. The dried *Cassia alata* L. leaves were ground into flour with a size of 60 mesh. The simplicia of *Cassia alata* L. leaf was made by mixing with 70% ethanol as a solvent for 24 hours, then extracted by the MAE (*Microwave Assisted Extraction*) method and following the steps of Natsir et al. [7].

TABLE 1. Nutrient content of broiler feed for starter and finisher periods.

Nutrients	Periods			
	Starter		*Finisher*	
	Lab Analysis [1]	Feed Labels [2] CP 511	Lab Analysis[1]	Feed Labels [2] CP 12G
BK (%)	89.97	max 86	89.83	max 86
PK (%)	23.57	min 20	22.35	min 19
LK (%)	5.77	min 5	6.10	min 5
SK (%)	1.88	max 5	5.79	max 6
Abu (%)	7.07	max 8	7.46	max 8
Fosfor (%)	-	min 0.50	-	min 0,45
Ca (%)	-	0.80 – 1.10	-	0.80 – 1.10
Lisin (%)	-	min 1.20	-	min 1.05
Metionin (%)	-	min 0.45	-	min 0.40

Source:
1 The results of the analysis of the Central Laboratory of the University of Muhammadiyah Malang.
2 Table of the nutritional content of PT. Charoen Pokphand Indonesia Tbk.

Research Methods

The method used in this study was an experimental arranged in Completely Randomized Design (CRD). The treatment used in this study consisted of 5 experimental treatments with 4 replications with different extract doses. The treatments consisted of:
PO(-) Commercial feed
PO(+) Commercial feed + 0.1% *Tetracycline* antibiotic
P1 commercial feed + 0.4% *Cassia alata* L. leaf extract.
P2: commercial feed + 0.8% *Cassia alata* L. leaf extract.
P3: commercial feed + 1.2% *Cassia alata* L. leaf extract.

The parameters observed were carcass quality (carcass weight, breast percentage, and abdominal fat), and physical quality of chicken meat (cooking loss, water holding capacity, and tenderness).

Data Analysis

The data obtained were analyzed using the Analysis of Variance (ANOVA) by using the Microsoft Excel 2010 application. If the results showed a significant effect ($P<0.05$) or very significant ($P<0.01$), then continued with Duncan's Multiple Distance Test.

III. Results and Discussion

The effect of adding *Cassia alata* L. leaf extract to broiler feed on carcass quality (carcass weight, breast carcass percentage, abdominal fat, cooking loss, water holding capacity, and tenderness) during the study can be seen in Table 2.

TABLE 2. Effect of leaf extract of *Cassia alata* L. on broiler carcass quality.

Variable	Treatment				
	P0(-)	P0(+)	P1	P2	P3
Carcass weight (g/ekor)	1,317 ± 60	1,349 ± 62	1,369 ± 35	1,394 ± 26	1,321 ± 68
Breast percentage (%)	35.16 ± 0.68	35.59 ± 0.83	35.89 ± 0.56	36.48 ± 0.54	35.22 ± 0,67
Abdominal fat (%)	1.16 ± 0.12	1.09 ± 0.21	0.94 ± 0.14	0.89 ± 0.10	1.13 ± 0.16
Cooking loss (%)	36.24 ± 1.15^{b}	35.03 ± 1.38^{ab}	33.77 ± 1.44^{ab}	33.15 ± 1.46^{a}	34.44 ± 1.23^{ab}
Water holding capacity (%)	27.31 ± 0.63^{b}	27.45 ± 1.22^{b}	29.07 ± 0.99^{ab}	29.73 ± 1.13^{a}	28.82 ± 1.44^{ab}
Tenderness (kg/cm^2)	1.74 ± 0.32	2.04 ± 0.41	2.37 ± 0.18	2.45 ± 0.40	2.27 ± 0.44

Notes: Different lowercase superscript notations on the same raw shows a significant effect ($P<0.05$).

The results of the analysis of variance showed that the treatments of additions *Cassia alata* L. leaf extract in the broiler diet showed a significant difference effect ($P<0.05$) on cooking loss and water holding capacity but had no significant effect on carcass weight, breast percentage, abdominal fat, and tenderness.

Carcass Weight

The results showed that there was no significant difference effect ($P>0.05$) in the carcass weight of broilers. This shows that the active substances in the *Cassia alata* phytobiotics in the broiler feed have not been able to change the carcass weight. The possible reason is flavonoid content found in *Cassia alata* L. leaf extract was 0,69 % GAE/g, much lower than previously reported by Angelina et al. [8] (6,67 % GAE). This could be attributable to different locations of cultivating the plant, fertilizer practices, and the age of harvesting the plant.

Though the addition of *Cassia alata* L leaf extract in the feed gave the best treatment with a concentration of 0.8% for the number of villi and the surface area of the villi of broiler [9], it

could not change the growth performance. With such a low level of flavonoid, it might need to increase the levels used or might select the plant which has a higher level of flavonoid.

Breast Meat Percentage

Breast meat is one of the important carcass parts of the broiler meat. It is calculated by dividing breast weight with carcass weight and multiplied by 100%. The results indicated that the addition of *Cassia alata* L. leaf extract did not have a significant effect (P>0.05) on the total percentage of broiler breasts at the age of 35 days. This is because the flavonoid content in the *Cassia alata* L. leaf extract was able to modify the population of microflora in the intestines of broiler but it has been too low to be able to change either carcass and breast weights.

Abdominal Fat

The results showed that abdominal fat in broilers was not significantly affected (P>0.05) by the addition of *Cassia alata* L. leaf extract *Cassia alata* L. leaf extract in the feed. This is because flavonoid is an active compound that has the ability to activate lipase enzymes. The lipase enzyme will convert excess fat in the body into fatty acids and glycerol so that abdominal fat would decrease. The previous experiment with the addition of *Sauropus androgynous* leaf extract in feed at an additional concentration of 17.07 g/kg can reduce abdominal fat in broilers [10]. The *Sauropus androgynous* leaf extract use contained phenol levels of 1.43 mg/g and flavonoids of 0.14%. This indicates that the chemical compounds present in the *Cassia alata* L. leaf extract should be able to reduce abdominal fat. Though the result was not significant, there has been a trend of decreasing abdominal fat, except with the use of the highest level of the *Cassia alata* L. leaf extract the *Cassia alata* L. leaf extract. The reason could not be explained in the current experiment.

Cooking Loss

The results showed that the addition of *Cassia alata* L leaf extract in the feed gave a significant (P<0.05) effect on the cooking loss value. The reason could be a lot of water is lost and nutrients are soluble in water due to the influence of cooking. Meat cooking loss in broilers is related to water holding capacity (WHC), the higher the WHC the lower the cooking loss of meat will be [11]. Another reason that meat with a low cooking loss value has a high WHC for chicken is because of the high protein content of the meat. The protein in the meat increases the ability to bind water. This is following the opinion of Prasetyo [12] who states that high cooking loss results in the weakening of protein bonds so that the ability to bind water weakens.

The average cooking loss of broilers in the study ranged from 43.01 to 64.92%. The cooking loss value of broiler meat is generally in the range of 1,5-54.5% [11]. The addition of nanoparticles *Curcuma longa Linn* extract in the feed on the physical quality of broiler meat aged 5 weeks also reported a significant effect on WHC if added at a concentration of 0.2 - 0.8% with the best result for a concentration of 0.8% [13].

Water Holding Capacity

The results showed that the addition of *Cassia alata* L leaf extract in broiler diets could significantly increase the WHC (P<0.05). This is caused by the presence of flavonoid in the *Cassia alata* L leaf extract. Flavonoids can increase the expression of insulin-like growth factor (IGF1) which acts as a mediator in fibroblast proliferation and collagen synthesis, thereby triggering the growth of muscle mass [14]. Protein functions as the main component in retaining water in the meat. Muscle protein has a hydrophilic nature, which interacts with water to form hydrogen bonds (binding water molecules in meat). Yuanita *et al.*, [15] explained that water in foodstuffs consisted of water chemically bound to hydration by muscle proteins. Muscle structural proteins, namely myosin, actin, and tropomyosin play a role in binding water out. So that the increased protein content of meat might cause the increased binding capacity due to the protein's ability to chemically bind water and lower the fat content of the meat.

Tenderness

The results showed that the addition of extract in the feed did not have a significant effect (P>0.05) on the tenderness of broilers meat, because the nutrients provided to each were almost the same treatment which causes the value of tenderness to be not different. According to Soeparno [11] that the content of food substances in feed can affect the value of meat tenderness. Increased protein in the feed in broilers can increase the rate of livestock growth so that the process of fat formation in meat will also increase. The fat content in chicken meat will affect the tenderness value of the meat [16]. The accumulation of fat can dissolve the collagen so that the meat becomes softer.

The average value of broiler tenderness in the study ranged from 1.74-2.45 kg/cm², where the average amount was still in normal conditions. Lyons *et al.* [17] reported that the tenderness of broilers ranged from 1.82 kg/cm² to 2.19 kg/cm². Meanwhile, the addition of *Cassia alata* L. leaf extract in the tenderness value tended to be low due to the presence of flavonoids in the feed affecting the absorption of fat by the digestive system of broilers. This is in line with research from Widymanda, *et al.* [18] explained that flavonoids have properties that can activate lipase enzymes. The lipase enzyme will convert excess fat in the body into fatty acids and glycerol, so there is no accumulation of fat in the body of broilers.

IV. Conclusion

The addition of leaf extract from *Cassia alata* L. up to a level of 1.2% as a broiler feed additive has not been able to improve the quality of broiler carcass which includes carcass weight, breast percentage, abdominal fat, and tenderness. The addition of *Cassia alata* L. in the feed gave the best results with a dose of 0.8% in terms of cooking loss and WHC.

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