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The Effect of Phytobiotic, Zinc, and their Combination in the Diet on Broiler Carcass Quality

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ABSTRACT

This study aimed to determine broilers' final body weight and carcass quality given herbs Temulawak (*Curcuma zanthorrhiza*) flour and Kencur (*Kaempferia galangal*) flour and zinc mineral. The research design was completely randomized with five treatments and four replications, each containing three broilers aged one day. The treatments (P) given included P1 (basal ration), P2 (basal ration + 2.5% Temulawak flour + 120 ppm mineral zinc), P3 (basal ration + 0.4% Kencur flour + 120 ppm mineral inc), P4 (basal ration + 2.5% Temulawak flour + 0.4% Kencur flour), and P5 (basal ration + 2.5% Temulawak flour + 0.4% Kencur flour + 120 ppm mineral zinc). The analysis of variance showed that the treatment had a significant effect ($P<0.05$) on final body weight, carcass weight, percentage, and carcass. But no significant effect ($P>0.05$), boneless percentage, bone percentage, meat and bone ratio, and abdominal fat. The combination of Kencur and zinc in the ration (P3) showed the best results in improving final body weight and carcass quality, including carcass weight. The provision of Temulawak flour and Kencur flour and the addition of zinc minerals to the feed did not negatively affect carcass quality.

Keywords: Boneless, broiler, kencur flour, meat to bone ratio, temulawak flour, zinc mineral.

INTRODUCTION

The utilization of medicinal plants or, more popularly, herbs as feed additives is starting to develop in the community. It happened after the regulation prohibiting antibiotic growth promoter (AGP) use by the Indonesian government as a feed additive in the poultry industry. As an agricultural country, Indonesia has many plant resources, including medicinal plants. The content of secondary metabolite compounds is efficacious for human and livestock health. The demands of the global community for products of animal origin that are safe for consumption make scientists in the field of nutritionists have to think about which feed additives are considered safe (Alkhalf et al., 2010).

Expectations for the use of medicinal plants, either singly or in combination, to improve poultry productivity are getting more prominent after several research reports showed positive results. The content of bioactive compounds in herbs which are the result of secondary metabolites, such as flavonoids and essential oils (Hidayat et al., 2021; Adriani and Mushawwir, 2020; Mushawwir at al., 2020[a,b,c,d]). This compound has antioxidant potential, antimicrobial and anti-worm activity (Abbas et al., 2017; Dinana et al., 2019; Jiwandini et al., 2020;). Temulawak (Curcuma zanthorrhiza) and Kencur (*Kaempferia galangal* L.) are medicinal plants that have these bioactive compounds (Hasanah et al., 2011; Andriyono, 2019; Kamil et al., 2020). The study's results on Peking ducks that were given the addition of kencur flour in the ration increased ration consumption and body weight gain (Herlina et al., 2021). Likewise, adding Kencur flour to a level of 1.5% in commercial feed can maintain the productivity of quail eggs (Ramadhani et al., 2021). In addition, medicinal plants made with potions also give positive results to poultry. Among other things, giving 5 mL of medicinal plant ingredients made from Kencur and Temulawak can reduce the percentage of abdominal fat of super free-range chickens (Tahalele et al., 2018).

The use of herbs in livestock as feed additives is termed probiotics. Phytobiotics are natural feed additives from plants that can increase the growth and feed efficiency of broiler chickens, prevent fat oxidation, improve intestinal morphology, and can function as natural antimicrobials to increase livestock endurance (Ripon et al., 2019; Tanuwiria et al., 2020[a,b]; 2022; Siregar et al., 2020; Rahmania et al., 2022). Phytobiotics such as Kencur and Temulawak can increase value by adding minerals because mineral supplementation is very important in percussion for immune response and disease resistance (Sanda & Ezeibe, 2015; Adriani et al., 2021). One of the minerals that can be added in the manufacture of herbal ingredients, namely mineral zinc.

This mineral can increase the immune response and broiler performance and can also increase body resistance (Hidayat et al., 2020). In broiler feed, zinc can be used as either organic zinc (e.g., Zn protein, Zn amino acid, or Zn picolinate) or inorganic zinc (e.g., $ZnCl_2$, $ZnSO_4$, or ZnO) (Hidayat et al., 2020; Kharazi et al., 2022). Therefore, this study aimed to see the final body weight and quality of broiler meat given herbs with added zinc mineral.

MATERIALS AND METHODS

Sixty broilers aged one day, strain Cobb 500, with a body weight average of 41.1 ± 0.08 g, was placed in 20 experimental cage units for 35 days. The experimental unit cages were made from bamboo splits measuring 100 x 60 x 50 cm (length x width x height), with a rice husk cage base of approximately 10 cm. Each experimental unit was completed with feed and drinking water. A 40-watt lamp for heating was installed in each experimental cage unit during the brooding period (days 1-7). During the study, additional light was given as lighting starting from 06.00 pm to 06.00 am. The other materials were disinfectant (rodalond) temulawak flour, kencur flour, mineral zinc (ZnO), hanging scales, and analytical scales with a 0.01-gram scale in this study. This study used an experimental method with a completely randomized design (CRD) consisting of five treatments and four replications, and each replication consisted of three broiler chickens. The treatments (P) given included P1 (basal ration), P2 (basal ration + 2.5% Temulawak flour + 120 ppm mineral zinc), P3 (basal ration + 0.4% Kencur flour + 120 ppm mineral zinc), P4 (basal ration + 2.5% Temulawak flour + 0.4% Kencur flour), and P5 (basal ration + 2.5% Temulawak flour + 0.4% Kencur flour + 120 ppm mineral zinc). Nutrient content of starter feed BR I 8202 GIANT produced from PT. Malindo Feedmil Tbk. The used are presented in Table 1.

Measured Variables

1. Final body weight

The final body weight was obtained by weighing the broilers at the end of the study.

2. Carcass weight

Carcass weight was obtained from weighing after the chicken was slaughtered without blood, feathers, head, neck, legs, and internal organs (grams). The relative carcass weight was obtained by comparing the carcass weight with the slaughter weight multiplied by 100%.

Table 1. Composition of Broiler Basal Feed Treatment

No	Content	Percentage (%)
1	Protein	19,0-21,0%
2	Fat	5,00%
3	Calcium	0,9-1,1%
4	Phosphorus	0,6-0,9%
5	Water content	13,00%
6	Fiber	4,00%
7	Ash	7,00%
8	Alfatoxin	50 ppb

Source: PT. Malindo Feedmill Tbk.

3. Percentage of a carcass

Carcass percentage was obtained by comparing carcass weight with slaughter weight multiplied by 100%.

4. Boneless Percentage

The weight of boneless meat is obtained from the weighting of boneless (grams). Boneless is obtained from all parts of the carcass. Boneless was obtained by comparing the boneless weight with the carcass weight multiplied by 100%.

5. Percentage of carcass bone

The bone percentage was obtained by comparing carcass bone weight with carcass weight multiplied by 100%. Bone is obtained from all parts of the carcass.

6. Bone meat ratio

The ratio of meat to bone is obtained by comparing the boneless weight with the bone weight multiplied by 100%.

7. Abdominal Fat

Abdominal fat weight was measured using fat obtained from around the gizzard and the fat layer attached to the abdominal cavity, collected, and then weighed. The percentage of abdominal fat is obtained by comparing the weight of abdominal fat with live weight multiplied by 100%.

Data analysis

The research data were processed statistically using analysis of variance based on a completely randomized design. If the treatment has a significant effect ($P < 0.05$), then a further test is carried out with Duncan's multiple area tests using Statistical Program for Social Science (SPSS) software.

RESULTS AND DISCUSSION

The results of the study of giving medicinal plants or herbs added with zinc minerals to the final body weight and carcass weight of broilers are presented in Figure 1. Furthermore, the average value of broiler carcass quality is presented in Table 2.

Final body weight and carcass weight

The variance results showed that the treatment had a significant effect ($P<0.05$) on the final body weight and carcass weight. The results of Duncan's multiple areas further tests showed significant differences ($P<0.05$) in final body weight and carcass weight of treatment P1 (control) with treatments P2, P3, P4, and P5. Likewise, with the treatment of P3 with P4 and P5. The average body weight value ranges from 1550.3 g to 1720.8 g. In comparison, the average value of carcass weight ranges from 1060 g to 1247 g. Final body weight and broiler carcass weight were higher in the treatment given the herbs of temulawak flour and kencur flour, which added zinc mineral. Likewise, the treatment of temulawak flour and kencur flour herbs are not added with zinc minerals. It shows that the herbs given alone or combined with other herbs and zinc minerals can be an alternative feed additive for broilers. Final body weight is the accumulation of daily or weekly broiler body weight gain (Hidayat, 2022[a]). The highest average final body and carcass weight values were found in the treatment with kencur flour added with zinc mineral (P3). It can be caused by the high level of ration consumption (unpublished data) because it has a good palatability value.

Kencur flour can increase the palatability of the ration because it has aromatic bioactive compounds. The basic components of kencur are essential oils such as Ethyl Trans-p-methoxy cinnamate and trans-ethyl cinnamate (Silalahi, 2019). There are bioactive compounds that are aromatic so that they become flavoring agents in the ration (Herlina et al., 2021; Nurmalia et al., 2020; Mushawwir et al., 2021). Plant-derived compounds that can promote growth (Wijayanti et al., 2021). The utilization of bioactive compounds produced by herbs is termed probiotics. The mineral zinc added in herbs can increase appetite, followed by increased body weight (Regar et al., 2013). Carcass weight is closely related to slaughter weight (final weight) and body weight gain (Haroen, 2003). The high average body weight value in the P3 treatment was also followed by high carcass weight. It indicates that the final body weight will affect the carcass weight. In other words, the higher the final weight, the higher the carcass weight produced.

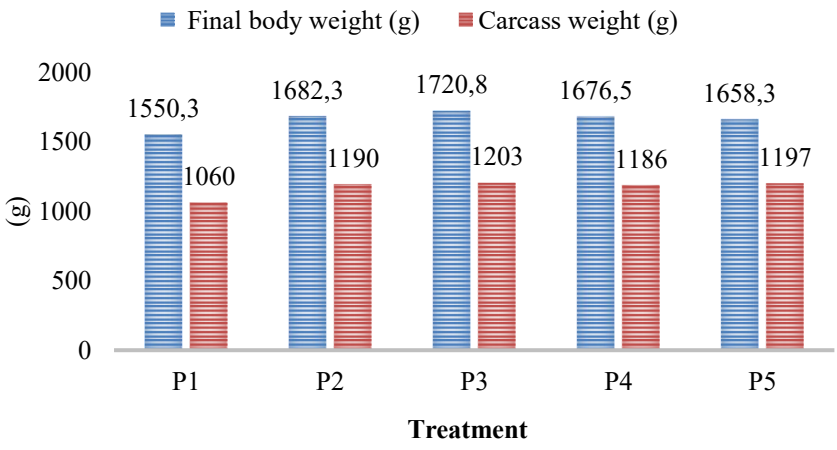

Figure 1. Average final body weight (g) and 35-day-old broiler carcass weight given herbal and zinc minerals. P1 (basal ration), P2 (basal ration + 2.5% Temulawak flour + 120 ppm mineral zinc), P3 (basal ration + 0.04% Kencur flour + 120 ppm mineral zinc), P4 (basal ration + 2,5% Temulawak flour + 0.04% Kencur flour), and P5 (basal ration + 2.5% Temulawak flour + 0.04% Kencur flour + 120 ppm mineral zinc).

Table 2. Average value of broiler carcass quality 35 days old given herbs and zinc minerals

Variable	P1	P2	P3	P4	P5
Carcass (%)	68,4[a]	70,9[b]	73,5[c]	70,8[b]	70,9[b]
Boneless (%)	77,1	77,5	77,5	72,2	77,4
Bone (%)	23,9	23,6	23,5	23,6	23,6
Meat : Bone Ratio	3,1	3,2	3,3	3,1	3,0
Abdominal Fat	2,08	2,26	2,78	2,61	2,15

Note: Different superscripts in the same line show significantly different effects (P<0.05). P1 (basal ration), P2 (basal ration + 2.5% Temulawak flour + 120 ppm mineral zinc), P3 (basal ration + 0.04% Kencur flour + 120 ppm mineral zinc), P4 (basal ration + 2 ,5% Temulawak flour + 0.04% Kencur flour), and P5 (basal ration + 2.5% Temulawak flour + 0.04% Kencur flour + 120 ppm mineral zinc).

Carcass Percentage

The variance results showed that the treatment had a significant effect (P<0.05) on the carcass percentage. Duncan's multiple area further tests showed that the percentage of carcasses treated P1 was significantly different (P<0.05) with treatments P2, P3, P4, and P5. Furthermore, the P3 treatment differed significantly (P<0.05) from the P2, P4, and P5 treatments. Successively the average carcass percentage value was 68.4-73.5. There was no significant difference (P>0.05) in carcass percentage between treatments P2, P4, and P5. The administration of temulawak flour and kencur herbs added with zinc mineral and combining the two herbs could improve the carcass percentage. This shows that the administration of herbs alone or with zinc added does not negatively impact the carcass percentage.

The percentage of standard carcasses ranges from 65-75% of live weight (Sulistyoningsih, 2014). In this study, the percentage of carcasses in all treatments was still in the normal range. The percentage of carcass tends to be higher in treating herbal kencur added with zinc minerals. The content of essential oils in kencur can increase the secretion of bile and pancreas which works cholokinetic and choleretic. The working principle of cholokinetic is the activity that plays a role in the biosynthetic process of increasing bile production in the liver due to the occurrence of active sodium curcumin in curcumin and the choleretic effect of increasing bile secretion from the gallbladder into the small intestine and further increasing fat metabolism which in turn increases Adenosin trifofat (ATP). The ATP from fatty acid oxidation is used in amino acid metabolism for growing muscle cells so that there is no fat accumulation in body tissues resulting in low fat and increased carcass weight (Sulistyoningsih, 2014).

In various types of livestock, body weight and carcass percentage have a very close relationship (Hafid et al., 2010; Hafid et al., 2018). The relationship between final body weight and carcass percentage in the study was very strong. This can be seen from R = 0.95 and R^2 = 0.90. The resulting regression model is Y= 476.82 + 1012X. This shows that each addition of one gram of body weight will increase the carcass percentage by 1.012 carcass percentage. In addition, various other factors can affect the percentage of carcass weight, such as ration consumption, weight gain, the nutritional content of the ration, and the number of wasted body parts such as offal, legs, head, neck, blood, and blood.

Boneless Percentage

The current study showed that the treatment does not significantly affect (P>0.05) on boneless percentage. The mean percentage of boneless in this study ranged from 77.1 to 77.5. However, the percentage of boneless in the treatment of temulawak flour and kencur flour added with zinc minerals (P2 and P3) was higher than in other treatments. The addition of zinc minerals to temulawak flour and kencur flour has a positive effect on the percentage of boneless.

Boneless is the meat part of the carcass that has been separated from the bone or can be interpreted as bone-free meat (Hidayat, 2022[b]). Boneless evaluation of carcass has very important uses. It can be used to measure the edible portion of the carcass and is used as a reference for measuring the level of production (Patriani, 2019; Suwarno et al., 2019; Hidayat, 2022). The formation of meat is supported by protein deposition in the body. The rate of protein deposition in the body, especially meat, is the difference between protein synthesis and degradation.

Bone Percentage

The variance results showed that the treatment had no significant effect (P>0.05) on the percentage of bone. The average value of bone percentage ranged from 23.5% to 23.9%. The highest bone percentage value was in the control treatment (P1), 23.9% and the lowest was in the kencur treatment with zinc added (P3) at 23.5%. The results of previous studies reported that broilers with body weight in the range of 851 g to 1050 g had a bone percentage of 30.27%, while broilers with body weights in the range of 1.451 g to 1,700 were 22.49% (Patriani, 2019). This shows that broilers that have a high final body weight tend to have a small bone percentage, on the other hand, have a high boneless percentage.

The relationship between final body weight and bone percentage in this study was very strong, with R = -0.9 and R2 = 0.8. The resulting regression model is Y= 2917.44 – 52.44X. Every one-gram increase in body weight will reduce bone by 52.44 grams. Thus the control treatment (P1) had the most minor decrease in bone percentage, whereas the P3 treatment had the most significant decrease in bone percentage. Therefore, the strong relationship between body weight and the bone percentage was negative in this study.

Meat to Bone Ratio

The variance results showed that the treatment had no significant effect (P>0.05) on the ratio of meat and bones. The mean ratio and bone values were in the range of 3.1 to 3.3. This study's provision of herbs and zinc minerals increased the average value of broiler meat and bone ratio. It can be seen that the average value of herbal treatment is higher than the control treatment (P1). In the study, the treatment of kencur which added zinc mineral (P3), had meat to bone ratio of 3.3. The high ratio of meat to bone in the P3 treatment could be due to the high final body weight at the time of slaughter. In previous studies, the ratio of meat and bone in broilers with body weight in the range of 1.451-1700 g was 3.48, while in body weight, the range of 851-1.050 g was 2.31 (Patriani, 2019). Therefore, the ratio of meat to bone is determined by the broiler's final body weight.

A good quality carcass is a carcass that has a more prominent meat component than bone (Sari et al., 2014). Generally, a low meat percentage will show a high bone percentage (Patriani, 2019). In this study, the treatment of kencur and zinc mineral (P3) had a high percentage of meat; thus, the quality of the carcass produced was also the best. The relationship between the boneless percentage and bone percentage in this study was quite intense with R = -0.92 and R2 = 0.85. The resulting regression model is Y= 99.45 – 0.96X. This shows that each addition of one percent boneless will reduce 0.96 percent of bone.

Abdominal Fat Percentage

The variance results showed that the treatment had no significant effect (P>0.05) on the abdominal fat percentage. The average value of the percentage of abdominal fat is in the range of 2.08 to 2.78. The lowest mean value was in treatment P1 (control) and the highest was in treatment P3. The administration of herbs and zinc minerals in this study has not reduced abdominal fat percentage. However, the percentage of abdominal fat is still within the normal range. The content of abdominal fat in the P3 treatment using kencur added with zinc minerals tends to be higher than in other treatments. However, the abdominal fat content in the P3 treatment was still within reasonable limits.

Excessive accumulation of abdominal fat can occur if broilers consume excess energy. There was no difference in abdominal fat content in the study between treatments because the rations consumed had relatively the same protein and energy. Abdominal fat will increase in chickens fed low-protein and high-energy rations (Fontana et al., 1993).

Abdominal fat correlates with total carcass fat; the higher the abdominal fat content, the higher the carcass fat content in broiler chickens. In addition to being able to reduce carcass weight, high fat is also considered not suitable for consumer health, so it is considered detrimental (Wijayanti et al., 2021). High abdominal fat weight can reduce product quality because it reduces carcass weight (Wijayanti et al., 2021). Therefore, the amount of abdominal fat in broilers determines the high and low quality of the carcass produced.

CONCLUSION

The combination of Kencur and zinc in the ration showed the best results in increasing the final body weight and carcass quality, including carcass weight. The provision of Kencur flour and the addition of mineral zinc did not harm carcass quality.

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