

Effect of Acidifier and Turmeric (*Curcuma domestica*) in Feed on Broiler Production Performance

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Abstract— Research aims to observe the effect of acidifier and turmeric flour (*Curcuma domestica*) addition in broiler feed on broiler production performance. The materials used in this were 240 broiler day-old-chick which were not differentiated by sex (unsex) average weight of 40.55 ± 1.69 g. They were reared for 35 days. The research method used was an in vivo experiment arranged in a Completely Randomized Design (CRD) with 6 treatments and 4 replications. Each replication used 10 broilers. The treatments used consisted of P0 commercial feed (basal feed + 0% acidifier + 0% turmeric flour), P1 (basal feed + 0% acidifier + 2.0% turmeric flour), P2 (basal feed + 0.5% acidifier + 1.5% turmeric flour), P3 (basal feed + 1.0% acidifier + 1.0% turmeric flour), P4 (basal feed + 1.5% acidifier + 0.5% turmeric flour) and P5 (basal feed + 2.0% acidifier + 0% turmeric). Variables observed in production performance were feed consumption, body weight growth, FCR, mortality, and IP. The results showed that the addition of acidifier and turmeric flour in broiler feed had no significant effect ($P > 0.05$) on body weight gain, but it showed significant effect ($P < 0.05$) on FCR and very significant ($P < 0.01$) effect on feed consumption and IP. Conclusion of the study was the addition of acidifier and turmeric flour in broiler feed with a dose of 0% acidifier and 2% turmeric flour gave the best results for IP values and a dose of 2% acidifier and 0% turmeric flour gave the best results in terms of FCR.

Keywords— Acidifier, turmeric flour, production performance, broiler.

I. INTRODUCTION

Broilers are one of the livestock commodities that play an important role in meeting protein needs in Indonesia. Broilers are a type of poultry with a fairly fast growth rate, slaughtered at the age of 35 days and the average body weight is 1.9-2.2 kg/bird. Broilers are characterized by large, fatty bodies, fast growth and produce protein-rich meat.

Feed accounts for 70% of production costs so feed is an important and strategic factor in increasing livestock productivity. Broiler production efficiency can be improved by the addition of feed additives. Farmers widely use antibiotics as feed additives to improve feed conversion efficiency, increase production and maintain health. The addition of antibiotics has been banned since May 2017 according to Article 16(2) of MOA 14/PERMENTAN/PK.350/5/2017 on the classification of veterinary drugs. Residues from the use of antibiotics in animal products can cause resistance in farm animals and pose a dangerous risk to human health if the product is consumed. One option is to replace antibiotics with natural antibiotics such as acidifiers and phytobiotics.

Acidifiers are feed additives added to feed or drinking water to improve digestibility by increasing the activity of digestive enzymes, lowering intestinal pH and maintaining the microbial balance of the digestive tract. Phytobiotics are plants that contain active chemical compounds that are proposed as feed additives to increase livestock productivity, reduce the impact of stress on the environment and produce no residue. One of the phytobiotics that can be given is turmeric which contains curcumin and has anti-microbial, anti-inflammatory and antioxidant potential effects [1]. The active substance of curcumin given to broiler chickens affects consumption levels, body weight gain and ration conversion values [2]. The curcumin in turmeric can increase appetite which in turn can increase live weight in broilers [3].

The combination of acidifier and turmeric flour added to broiler feed has not been widely studied. Turmeric containing curcumin is effective in increasing appetite because curcumin can accelerate gastric emptying so as to increase appetite and facilitate bile secretion which can improve digestion, while acidifiers improve digestive performance by lowering the pH of the digestive tract and maintaining microbial balance in the digestive tract. Based on this scientific information, a study is needed to evaluate the effect of ratio between acidifier and turmeric flour on broiler productivity which includes feed consumption, body weight gain, feed conversion, mortality, and performance index.

II. MATERIAL AND METHODS

The research was conducted at Mr. Amir's broiler farm on Jalan Perum Citra Pesona Buring Raya Blok D1, Malang City. Analysis of curcumin levels was carried out at the Gajah Mada University LPPT Laboratory. Overall, this research was conducted from October 2022 to January 2022.

The materials of this study were acidifier obtained from animal feed stores with the trade name PROS ACID G produced by Better Pharma Co., Ltd., turmeric flour (*Curcuma domestica*) derived from the flour of the rhizome of the turmeric plant produced by Materia Medika, and 240 Cobb strain broilers purchased from the commercial market.

This study used commercial feed produced by PT Japfa Comfeed, Indonesia. The commercial feeds consisted of both feed in the starter phase and finisher phase feed. The nutrients composition of basal feed can be seen in Table I.

TABLE I. Nutritional Contents of Basal Feed

Nutrient Content	Starter feed (BR I)	Finisher feed (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. 5,00%
Crude fiber	Maks.5,00%	Maks.6,00%
Calcium	0,80-1,10%	0,80 - 1,10%
Phosphor	Min. 0,50%	Min. 0,45%

Notes: produced by PT. Japfa Comfeed Indonesia Tbk.

The research method used was an experiment designed with a Completely Randomized Design (CRD) consisting of 6 treatments and 4 replicates. The treatments consisted:

P0 = Basal feed + 0% acidifier + 0% turmeric flour

P1 = Basal feed + 0% acidifier + 2.0% turmeric flour

P2 = Basal feed + 0.5% acidifier + 1.5% turmeric flour

P3 = Basal feed + 1.0% acidifier + 1.0% turmeric flour

P4 = Basal feed + 1.5% acidifier + 0.5% turmeric flour

P5 = Basal feed + 2.0% acidifier + 0% turmeric flour

The variables observed were:

1. Feed Consumption

Feed consumption is the amount of feed consumed by the birds during the rearing period. Feed consumption is calculated from the amount of feed given minus the remaining feed. Feed consumption can be calculated daily, weekly, or at the end of rearing from 1-35 days of age [4]. In this study, feed consumption was obtained from the average feed consumption for one week taken in the morning.

2. Body weight gain

Body weight gain is the increase in body weight as an expression of the growth achieved by broilers during the rearing period. Body weight gain can be observed by weighing chickens every week in each experimental unit [4].

$$PBB (g) = \text{Final body weight (g)} - \text{Initial body weight (g)}$$

3. FCR

Feed conversion ratio (FCR) is a value used to determine how well feed is converted by livestock into meat in a certain unit of time. Feed conversion value is related to consumption and body weight gain in the economic aspect. The higher the conversion value, the more wasteful it is in financial terms because a high conversion value indicates higher feed consumption but low body weight gain [4].

$$\text{Feed Conversion} = (\text{Feed Consumption (g)})/(\text{PBB (g)})$$

4. Mortality

Mortality indicates the number of chickens that die during broiler rearing. Mortality is calculated by comparing the number of chickens that die during rearing period with the initial number of chickens. The formula for calculating mortality [4]:

$$\text{Mortality (\%)} = (\text{Number of dead chickens (bird)})/(\text{Initial population (bird)}) \times 100\%$$

5. Production index

IP (performance index) is a parameter to see the efficiency of a broiler production because this indicator involves mortality, FCR and marketed age [4].

$$IP = (\text{Percentage of Live Chickens} \times \text{Body Weight})/(\text{Feed Conversion} \times \text{Length of Rearing}) \times 100$$

6. Statistical Analysis

The data obtained were then tabulated using the Excel program and processed by analysis of variance (ANOVA). 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 production performance during the study are presented in Table II.

TABLE II. The effect of treatment on the production performance

Treatments	Variable			
	Feed Consumption (g/bird)	Body weight gain (g/bird)	FCR	IP
T0	3339±122 ^b	1738 ± 25	1.92 ± 0.07 ^b	240 ± 20 ^a
T1	3151±36 ^a	1789 ± 50	1.76 ± 0.07 ^a	290 ± 19 ^b
T2	3225±108 ^b	1797 ± 25	1.79 ± 0.05 ^a	272 ± 18 ^a
T3	3126±5 ^a	1774 ±15	1.76 ± 0.02 ^a	288 ± 5 ^b
T4	3117±11 ^a	1761 ± 42	1.77 ± 0.04 ^a	284 ± 13 ^b
T5	3050±66 ^a	1751± 29	1.74 ± 0.06 ^a	287 ± 14 ^b

1. Effect of Treatment on Feed Consumption

Based on the results of observations and analysis of variance showed that the treatment of acidifier and turmeric flour in feed showed a very significant difference effect ($P < 0.01$) on broiler feed consumption. Broilers that were not treated had a higher feed consumption value than the provision of acidifier and turmeric flour, which amounted to 3339 ± 122 g/bird. This is because feed consumption is generally influenced by feed palatability. The addition of acidifier and turmeric flour affects palatability. The results showed that the response to the use of

acidifier at the level of 0.5% combined with 1.5% turmeric flour increased feed consumption compared to turmeric alone (2%), even the value of feed consumption was statistically not significantly different from the control treatment but the increase in acidifier levels above 0.5% to 2% caused feed consumption to decrease.

Research using a combination of acidifiers with the trade name Orgacid™ in pigs was reported to reduce feed consumption insignificantly due to palatability factors [5]. Orgacid is an acidifier that can create an acidic atmosphere for the digestive tract so that pathogenic microbes which usually

live in an alkaline atmosphere will be difficult to grow. This condition is very favorable for monogastrics whose digestive process uses mainly enzymatic and the digestive process becomes optimal if its tract is not disturbed by pathogenic bacteria. The lowest feed consumption is broilers given acidifier as much as 2%, which is 3050 ± 66 g/bird. Acidifier used which contains formic acid, lactic acid, propionic acid, citric acid, silicon dioxide, and carrier, can reduce the growth of pathogenic bacteria. According to [6], the addition of organic acids, such as citric acid to feed can suppress the growth of pathogenic bacteria. The decreased number of pathogenic bacteria results in reduced competition between these bacteria and the host in utilizing feed nutrients. Feed that enters the digestive tract can be utilized better and reduce nutrients utilized by pathogenic bacteria, thus reducing feed consumption.

Broiler feed consumption decreased in feed containing turmeric flour due to the essential oil which has a distinctive and bitter taste. The addition of 0.1% turmeric tends to reduce feed consumption [7]. The results of research by [8] also explained that the addition of turmeric flour up to 0.16% tended to reduce the feed consumption of broilers aged 2 weeks to 7 weeks. The results of study [9] who added that essential oils in cloves and oregano also reported have a sharp odor. The odor is thought to decrease palatability which causes feed consumption to decrease significantly. The decrease in feed consumption is also supported by [10] who explained that the addition of 0.5% turmeric in feed can reduce feed consumption but gives a good response to body weight gain and FCR value.

2. Effect of Treatments on Broiler Body Weight Gain

The results of statistical analysis showed that the addition of acidifier and turmeric flour in broiler feed gave no significant difference effect ($P > 0.05$) on broiler body weight gain. The factor that plays an important role in influencing the growth rate is feed consumption [11]. The results of research on feed consumption showed that the addition of acidifier and turmeric flour did not cause an increase in feed consumption. If broilers consume large amounts of feed and body weight gain is not high, it is suspected that the absorption of feed in the broiler's digestive tract is incomplete [12]. Factors affecting body weight include genetics, health, nutritional value of feed, balance of feed substances, stress, and the environment [13].

Based on the results presented in Table 2, it is known that the provision of acidifiers and or turmeric flour has a greater body weight gain than without the provision of acidifiers and or turmeric flour. According to [14] acidifiers play 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 they have an impact on the health of the digestive tract, so that it will improve the function of the digestive tract in digesting and absorbing nutrients, especially protein. By that broiler performance or appearance is more optimal. The provision of acidifiers containing citric acid increased body weight insignificantly compared to the control treatment [15]. The results showed that broiler body weight decreased when the percentage of acidifier was increased.

According to [16] giving too high acidifier causes the work of digestive enzymes to be disrupted and productivity decreases.

Turmeric flour containing curcumin can increase body weight. The provision of curcumin [17] can increase growth in broilers due to the presence of curcumin which can stimulate the synthesis of digestive enzymatic organs so that digestive performance can be optimized. This is supported by [10] in her research which explains that giving 0.5% turmeric as additional feed can reduce feed consumption but gives a good response to body weight gain. The results showed that body weight gain increased when the percentage of turmeric flour was increased to 1.5% and decreased again when the percentage of turmeric was increased by 2%. This is due to decreased feed consumption, which causes decreased body weight gain. Research by [18] explains that the provision of increased doses of turmeric and ginger in broiler feed causes a decrease in body weight caused by a decrease in palatability and feed consumption while the factor that affects body weight is feed consumption both in quality and quantity.

3. FCR

The results of statistical analysis showed that the addition of acidifier and turmeric flour in broiler feed gave a significant difference effect ($P < 0.05$) on broiler feed conversion ratio (FCR). FCR is influenced by feed consumption and body weight gain [19]. The results of the study on increased body weight did not show significantly different results ($P > 0.05$) while broiler feed consumption decreased showing very significant differences ($P < 0.1$).

The FCR value in this study is higher than the opinion of [20] that the standard FCR of broiler strain Cobb at 5 weeks of rearing is 1.50. However, [19] stated that each broiler rearing period has a different FCR value, and the average FCR of broiler farms generally varies between 1.52 - 1.88. This is thought to be due to several influencing factors such as the type of feed used, environmental conditions, and rearing management methods applied.

Based on Table 2, it is known that the highest FCR is broilers that are not given acidifier and or turmeric flour. FCR is the ratio between feed consumption and body weight gain in one week during one production period. The lower FCR can be one of the references for good rearing management. According to [21], the higher the FCR value, the more feed is needed to increase body weight per unit weight. Therefore, [22] added that the lower the FCR value, the better the broiler absorbs feed and is converted into meat. FCR is useful to see the efficiency of feed used or the efficiency of feed use converted into the final product in broilers is the formation of meat. Low weight gain can be caused by pathogenic bacteria that develop in the digestive tract and interfere with nutrient absorption. High feed consumption due to unmet broiler needs while the absorption process is not optimal makes the final weight value low [23].

According to [24] the provision of organic and inorganic acids can significantly reduce FCR. Giving synthetic or natural citric acid (lime juice) to step down feed can improve FCR [25]. Acidifiers are considered capable of creating an acidic atmosphere for the digestive tract so that pathogenic bacteria that live in an alkaline atmosphere are difficult to develop.

Acidifiers in poultry feed can reduce the pH value in the digestive tract of poultry. A decrease in pH in the digestive tract can increase the digestibility of feed protein [26]. Therefore, [27] reinforced that organic acid supplementation can increase nutrient utilization resulting in high body weight gain and ultimately reduce feed conversion.

According to [17] the addition of turmeric flour up to 10 g/kg in feed has a significant effect on reducing FCR and increasing growth in broilers due to the presence of curcumin which can stimulate the synthesis of digestive enzymatic organs. The active substance of curcumin given to broilers affects consumption levels, body weight gain, and feed conversion values [2].

4. Mortality

Mortality is one of the indicators that can be considered as the success rate of a broiler cultivation management. The results showed that during the first week there were no deaths in all treatments. Mortality began to occur in the second week in P0 (without giving acidifier and turmeric flour) as many as three chicks and P2 (giving 0.5% acidifier and 1.5% turmeric flour) as many as one chick. While in the fourth week of rearing there was one death in the P2 treatment. The mortality rate in this study was 2.08% of 240 chickens which is still within the normal limit of broiler mortality of 5% [28]. The lower the mortality rate indicates that animal management and welfare is fulfilled.

5. Production index

The results of statistical analysis showed that the addition of acidifier and turmeric flour in the feed showed a very significant difference in effect ($P > 0.01$) on the production index. This is because the IP value involves indicators of feed consumption, PBB, FCR, and mortality. Feed consumption and FCR during the study had a significant effect. The value of broiler body weight gain had no significant effect but had numerical differences. The results showed that the largest mortality percentage was broilers without acidifier and or turmeric flour.

A high production index value indicates good maintenance. According to the explanation of [29] that performance testing is an activity carried out to assess the success of a poultry farming business. Factors used to test the performance of poultry are feed consumption, body weight, feed conversion, and percentage of mortality. The results showed that broilers without acidifier and or turmeric flour had lower performance index values than those with acidifier and or turmeric flour. The best performance index value occurred in broilers treated with a balance of 0% acidifier and 2% turmeric flour due to the average feed consumption factor of 3150.61 ± 36.48 g/head, body weight gain of 1789.25 ± 49.85 , FCR 1.76 ± 0.07 and no deaths during the 35-day rearing period. The IP in this study is below the sufficient criteria suggested by [4]. According to [4] if the IP result < 300 means including poor criteria, if the value of 301-325 means including fairly good criteria and if the IP value of 326-350 means including good, if the IP 351 - 400 means including very good criteria and if the IP value > 400 means including excellent criteria. This is because the FCR value of all treatments is high while FCR involves feed

consumption and PBB which is also an indicator of production index. [20] states that the standard of Cobb broilers FCR in the 5-week rearing period is 1.50

IV. CONCLUSION

The addition of acidifier and turmeric flour (*Curcuma domestica*) in feed has similar feed consumption with control group fed basal feed, but with no changes in body weight gain. The addition, acidifier and turmeric flour combination could reduce FCR, and therefore improve IP value.

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