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Research Article

The Effectiveness of Curcuma (*Curcuma xanthorriza* Roxb.) Addition in the Feed toward Super Kampong Chicken Performances

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Abstract: Research purposes were to analyze the effect of *curcuma* in the feed toward the performances of kampong super chicken. The research materials used were 100 DOC (Day Old Chick) super kampong chicken The variables was: body weight gain, body weight, consumption, feed conversion ratio, carcass weight, abdominal fat weight, meat fat content, meat protein content, fat digestibility, crude fiber digestibility, protein biological value, and nitrogen retention. The experimental design in this study used a Completely Randomized Design (CRD). The treatments as follows: T0: Feed without curcuma 0.0 % (as control), T1: Feed with curcuma 0.33 %, T2: Feed with curcuma 0.67 % and T3: Feed with curcuma 1.00 % with five replications. The results of research, giving curcuma as feed additive had a significant effect on body weight gain and final body weight of kampong super chicken but it had no significant effect on feed consumption, feed conversion ratio, carcass weight, abdominal fat weight, fat content meat, meat protein content, fat digestibility, crude fiber digestibility, protein biological value and nitrogen retention of kampong super chicken. There were no significant differences between T0 and T1, but it was different from T2 and T3, and T2 showed no difference with T3 on body weight gain and final body weight. The best treatment in this study was T0 and T1, namely the addition of curcuma 0 % and 0.33 %. From the conclusion, we suggest using 0.33 % curcuma as feed additive in the super kampong chicken feed for body weight gain and final body weight.

Keywords: Alternative feed additive, Feed security, Food efficiency, Herbal medicine, Local poultry, Minimize hazardous chemical .

1. INTRODUCTION

1.1 Background

Food and feed security need attention because Indonesia is still experiencing destabilization. One of them is fed resistance in local poultry, especially kampong chickens (native chicken - *Gallus gallus* domesticus Linnaeus, 1758), ducks (*Anas platyrhynchos* domesticus Linnaeus, 1758) and quails (*Coturnix coturnix* Linnaeus, 1758) which are still less than imported poultry. Local poultry still needs feed that is still primarily imported, including feed additive. Feed additives are commonly factory-made medicines containing many dangerous chemicals, and the prices are volatile. Herbal medicine as local potential can be used as an alternative substitute for feed additives with cheap price and safe from hazardous chemicals.

Herbs are traditional medicines in the form of plant material, animal material, mineral materials or mixtures of these materials. Various herbal materials derived from herbal plants found in Indonesia have the potential to be used as feed additives. Materials of medicinal plants are made according to their interests and functions selected from one type or several types of medicinal plants, including

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curcuma (*Curcuma xanthorriza* Roxb.), turmeric (*Curcuma longa* L.), galangal [*Alpinia galangal* (L.) Willd.], ginger (*Zingiber officinale* Roscoe.) and others are used to increase performances of poultry.

Curcuma as one of feed additive is a medicinal plant has properties can increase appetite. The use of curcuma in feed is still not done commercially. It is due to the lack of up-to-date research on its use. In addition, processing independently also makes farmers not use it as feed additive.

Curcuma contains curcumin, xanthorrizol and essential oils. The bactericidal study, as determined by the viable cell count method, revealed that xanthorrhizol treatment at 4× MIC (minimum inhibitory concentration) reduced viable cells by at least 6 log to 8 log for all six foodborne pathogens in 4 h. Xanthorrhizol maintained its antibacterial activity after thermal treatments (121 °C, 15 min) under various pH ranges (pH 3.0, pH 7.0, and pH 11.0). These results strongly suggest that xanthorrhizol, conferring strong antibacterial activity with thermal and pH stability can be effectively used as a natural preservative to prevent the growth of foodborne pathogens [1]. According to [2], curcuma can shorten the acid cycle of the stomach and accelerate the release of blood sugar from the body cells. This low level of sugar in the blood means accelerating the cycle of hunger in chickens and can reduce stress risk [3].

Compounds in curcuma are believed to stimulate hunger in chickens and can spur body weight gain so that they can reach final body weight faster than usual maintenance time. Maintenance of super chicken was carried out until the chicken body weight reached 800 g, with the addition of curcuma added daily body weight gain was higher than general maintenance. Therefore, research is needed on adding curcuma to the feed to find out the effect of curcuma toward performances of kampong super chicken so that maintenance can be done the faster time.

1.2. Research Problem

i) Does the addition of curcuma in the feed affect the performances of kampong super chicken?
ii) What is the optimal level of addition of curcuma in the feed toward the performances of kampong super chicken?

1.3. Research Purposes

i) To analyze the effect of the addition of curcuma in the feed toward the performances of kampong super chicken.
ii) To see the best level of curcuma addition in the feed toward the performances of kampong super chicken

2. MATERIALS AND METHODS

This research was conducted in January 2019, taking place at the Closed House and Laboratory of Animal Science, Faculty of Agriculture and Animal Science, University of Muhammadiyah Malang, Tegalgondo Village, Karangploso District, Malang Regency, Indonesia. The research materials used were 100 DOC (Day Old Chick) super kampong chicken and the addition of curcuma in the feed. The variables used in this research was: body weight gain, body weight, consumption, feed conversion ratio, carcass weight, abdominal fat weight, meat fat content, meat protein content, fat digestibility, crude fiber digestibility, protein biological value, and nitrogen retention.

The research method used in this study was the experimental method. The experimental design in this study used a Completely Randomized Design (CRD). The treatments as follows: T0: Feed without curcuma 0.0 % (as control), T1: Feed with curcuma 0.33 %, T2: Feed with curcuma 0.67 % and T3: Feed with curcuma 1.00 % with five replications. The data were analyzed by Variance Analysis (ANAVA). Furthermore, if the research results are significantly followed by the Least Significant Difference (LSD).

3. RESULTS AND DISCUSSION

The result of the addition of curcuma as feed additive in this research can be shown in the Table 1 below.

Giving curcuma as feed additive had a significant effect ($P < 0.01$) on body weight gain and final body weight of kampong super chicken but it had no significant effect ($P > 0.05$) on feed

Table 1. Effect of the addition curcuma in the feed toward performances of super kampong chicken.

Variable	Treatments			
	T1	**T2**	**T3**	**T4**
Body weight gain (g/head/d)	14.45±1.11[a]	13.83±0.24[a]	12.72±0.72[b]	12.21±0.70[b]
Final body weight (g)	853.67±62.72[a]	817.25±14.17[a]	755.13±40.00[b]	724.92±39.00[b]
Feed consumption (g/head/d)	43.49±2.04	41.88±2.50	39.60±4.64	39.28±1.61
Feed conversion ratio	3.02±0.16	3.03±0.21	3.02±0.44	3.22±0.14
Carcass weight (g)	455.00±34.79	490.00±60.18	481.20±43.67	523.00±15.91
Abdominal fat weight (g)	9.30±4.16	6.99±0.41	11.01±3.15	10.95±5.42
Meat fat content (%)	2.61±1.13	2.19±0.37	2.31±0.57	1.90±1.30
Meat protein content (%)	82.98±1.70	81.89±2.23	82.17±3.24	81.59±1.46
Fat digestibility (%)	88.66±5.72	88.62±2.32	89.16±2.43	89.42±7.20
Crude fiber digestibility (%)	44.67±16.18	42.36±7.92	40.17±9.08	45.57±12.91
Protein biological value (%)	69.55±9.77	71.65±9.35	74.58±10.64	63.48±9.41
Nitrogen retention (g)	0.61±0.12	0.59±11	0.60±0.12	0.53±0.11

Notes:
i) The numbers with alphabets superscript (a and b) show there was significant effect. If the superscripts had the same word in the line, so the meaning was no differences in the treatments and vice versa.
ii) The numbers without alphabets superscript show there was no significant effect in the treatments.

consumption, feed conversion ratio, carcass weight, abdominal fat weight, fat content meat, meat protein content, fat digestibility, crude fiber digestibility, protein biological value and nitrogen retention of kampong super chicken. There were no significant differences between T0 and T1, but it was different from T2 and T3, and T2 showed no difference with T3 on body weight gain and final body weight. The best treatment in this study was T0 and T1, namely the addition of curcuma 0 % and 0.33 %. This is supported by [4] states that the addition of 0.3 % turmeric does not have a negative effect such as a decrease in palatability and decrease in weight. On the other hand, turmeric and curcuma have less difference.

Jantan et al. [5] states essential oils and curcumin have the property of stimulating liver cells to increase bile production and facilitate bile secretion, so that bile fluid increases. It will reduce the solid particles found in the gallbladder. Bile functions to dissolve fat. With smooth bile secretion can facilitate digestion and fat emulsion. Curcuma can accelerate gastric emptying, thus arising from hunger and stimulating the appetite.

According to [6], essential oils and curcumin have the property of stimulating liver cells to increase bile production and facilitate bile secretion, so that bile fluid increases. It will reduce the solid particles found in the gallbladder. The smoothness of bile secretion can facilitate digestion and fat emulsion, so the carcass fat is small and affects body weight. Widodo et al. [7] added curcumin is the ability of bile to excrete bile salts which have the function of activating lipase in pancreatic fluid, emulsifying fat, helping absorb fat and fat-soluble vitamins, as a stimulant for the flow of bile from the liver and keeps cholesterol dissolved in the liquid [8]. *Curcuma* affects the performance of the pancreas, increases appetite, can accelerate gastric emptying so it will increase hunger and stimulate appetite.

According to [9] *Curcuma* is included in natural antibiotics and does not cause residues or is harmful if consumed by livestock and humans. Giving *Curcuma* in the feed or water for chickens can increase appetite which in turn can increase chicken body weight. Feed mixed with essential oils given to broilers has been shown to improve

feed conversion, increase body weight gain, reduce mortality. However, in this study feed conversion in kampong chickens was not optimal because of the high ration conversion value.

The decrease in the treatment of T2 and T3 is suspected the decrease in palatability caused by the amount of treatment given, besides that the greater the treatment is given will make the feed more smelling typical of *Curcuma*. Suriya et al. [10] made it clear that the content of essential oils in *Curcuma* has a sharp taste and a distinctive odor so that use for poultry must be limited. Adha et al. [11] added essential oils have a distinctive smell and bitter taste that can reduce appetite. Decreased palatability is caused by the emergence of bitter and smelly sensations. Essential oils have a distinctive taste and aroma when used in poultry rations need restrictions on the feed [12]

Zakaria, et al. [13] said the addition of *Curcuma* is recommended in the form of extracts so that the aroma, taste, and nutrition can be improved with a not too stinging aroma, a taste that is not too bitter, and anti-nutrients can be minimized. Addition of *Curcuma* on feed showed no significant effect on feed conversion feed consumption, carcass weight, abdominal fat weight, meat fat content, meat protein content, fat digestibility, crude fiber digestibility, protein biological value, and nitrogen retention of super kampong chicken. It is because treatments get the same amount of feed nutrients, which means the protein balance and energy given are the same. Ginger in feed has not affected it because ginger which contains essential oils has not worked optimally. It is due to the lack of ginger mixture in feed which results in less optimal feed conversion feed consumption, carcass weight, abdominal fat weight, meat fat content, meat protein content, fat digestibility, crude fiber digestibility, protein digestibility, protein biological value, and nitrogen retention. Giving more than 1 % is likely to affect the various variables above. It is in line with the opinion of [14] said that giving ginger rhizome more than 1 % in broiler rations can increase appetite and dry matter consumption, which will affect slaughter weight and carcass production, while the presentation of carcass fat decreases.

The high ration conversion value causes the feed given to be less efficient to increase the daily body weight of super chicken for 8 wk of maintenance. High conversion values are caused by low palatability, while at 0 wk to 8 wk the nutritional needs of native chickens are highest. The nutritional needs of the highest chicken during (0 wk to 8 wk) of life, therefore it is necessary to provide rations that contain enough energy, protein, minerals, and vitamins in a balanced amount [4].

Addition of ginger flour is not optimal in shaping carcass weight and better weight of abdominal fat. Addition of *Curcuma* flour on feed causes a decrease in palatability. *Curcuma* flour has a strong aroma and bitter taste which is still strong enough to affect feed consumption and affect carcass and abdominal fat weight. The dose of ginger is probably not optimal. The lack of doses of ginger added to feed is supported by [15] study that the frequency of giving 3 % of ginger flour in feed does not have a significant effect.

There are many factors that influence the carcass weight and super chicken abdominal fat including genetics, environment, nation, sex, age, and health, and cage density. The same thing was expressed by [16] stated the formation of carcass and abdominal fat in broilers was influenced by several factors including the composition of feed, temperature, environment, cage density, and age and genetics. Super kampong chicken has the same behavior as ordinary chicken, which is agile, crows, likes to perch, and is resistant to disease. Agile behavior in super kampong chickens makes the nutrients that enter the body are changed in the form of energy that is used for active activities. Energy needs in the body are digested for activity so that low-fat accumulation due to excess energy generated from metabolic processes in the body.

Giving *Curcuma* in rations had no significant effect ($P > 005$) on the fat and protein content of super kampong chicken meat. It is caused by the nutritional content contained in *Curcuma*, such as xanthorizol which can only inhibit fungal growth in the body and cannot reduce the level of crude fat in the body of the chicken. Rahim, et al. [12] stated that *Curcuma* is an additional feed used in rations to stimulate growth and improve feed efficiency by reducing disrupting microorganisms and increasing beneficial microbial populations, which are in the digestive tract of chickens so that

feed efficiency increasing. The average crude fat content of meat in this study was 1.90 % to 2.61 %. The crude fat content in meat is normal because according to [18] the crude fat content of chicken meat is on average 10.21 %, while in kampong chicken the crude fat content is lower than broiler chicken. Meat fat content is affected, among others, by muscle location, muscle type, sex, and age of livestock. The percentage of fat generally increases by age but can change at any time depending on the food consumed. The crude fat content in livestock body is obtained from the excess energy consumed, the rations consumed with excessive energy will be stored in the form of fat so that the higher the energy content of the ration, the higher the fat content in the body. The crude fat consumed by super kampong chickens is metabolized by the body to degrade *Salmonella* sp., so that it can affect the fat content of super kampong chicken meat.

Increasing activity of digestive enzymes and regulation of microbial activity causes digestion of feed to increase and cause digestibility of proteins and minerals to be absorbed properly by the intestine, which eventually can absorb more of the animal's body. However, the content of curcumin added in the ration is not optimal to be able to stimulate hormone secretion so that it is not able to reach the target organs which can affect the content of crude protein content of super chicken meat. The protein content contained in the feed-in each treatment was relatively the same during maintenance, which was as much as 20%, so it did not show any difference between treatments. According to [6] protein synthesis for growth is influenced not only by the availability of energy, the amount of food consumed and the energy balance of the protein but also by the nitrogen absorbed. Feed consumption is not significantly different causes the nitrogen absorbed relatively the same so that it will give the same effect on the growth of broilers.

The meat's crude protein ranges from 81.58 % to 82.97 %. This value turns out to be higher than the level of crude protein in the kampong chicken generally. This is in accordance with the opinion of [18] states that the protein content of kampong chicken meat for dry weight reaches 47.21 %. The results of this study are in line with [7] research that the effect of adding *lempuyang (Zinfiber Zenembet* (L.) J.E.Smith) to the herbal mixture has a significant effect on the ash and protein content of super kampong chicken meat. The average level of protein produced in chicken meat in the previous study with the addition of *lempuyang* in the mixture of herbs was 70.99 %. Addition of *Curcuma* in rations on super kampong chicken did not significantly influence digestibility of crude fat, crude fiber, the biological value of protein and nitrogen retention of super kampong chicken ($P > 0.05$). It shows that the nutrient content in the rations and active compounds in *Curcuma* still cannot optimize the curcumin substance to increase bile secretion. According to a previous study that the ingredients are found in *Curcuma* could metabolize body fat and can reduce cholesterol levels and be hypocholesterolemia. Curcumin plays a role in increasing bile production and secretion, stimulating the release of pancreatic sap which can increase the metabolism of carbohydrate, protein and fat ingredients so that the digestive process takes place quickly and optimally.

The mechanism of action of the curcumin substance is to stimulate the gallbladder wall to expel bile so that it can facilitate fat metabolism. Fat digestion requires the presence of bile salts produced by the liver and stored in the gallbladder. The bile is released when the gallbladder is stimulated by the presence of food ingredients in the intestine. Pancreatic lipases digest triglycerides into fatty acids and monoglycerides. The pancreas affects each other with bile salts to form microparticles (micelles), which dissolve fat digestion products so that these substances can be absorbed properly. This condition allows bile salts to not neutralize the acidity of the intestinal contents in the duodenal groove area and produce an alkaline state so that the digestibility level is not appropriate [6].

According to previous research [19] crude fat digestibility is not significant because feeding with nutrient content of feed in each treatment is relatively the same, especially the crude fat content of the feed given, the digestibility of crude fat will also be relatively the same. The *Curcuma* has essential oils and curcumin, which is able to suppress the growth of microorganism. According to [20] one of the properties of curcumin is as an anti-bacterial and essential oil has properties as an antiseptic, wherein this antiseptic can inhibit the growth of microorganisms and increase appetite

in chickens. When the growth of microorganisms in digestion decreases, the digestive power in digestion increases so that the content in crude fiber that can be digested will also be digested properly. However, the administration of *Curcuma* up to 1 % has not given a significant effect on the digestibility of crude fiber super kampong chicken.

This less significant effect of *Curcuma* can occur because several other factors, including the crude fiber content in the ration and the amount of crude fiber consumed. Besides [4] also added digestibility is closely related to chemical composition and crude fiber has the greatest influence on digestibility. The level of crude fiber is high, the digestion of nutrients will be longer and the value of productive energy will be lower, but if the level of crude fiber is low, the digestion of nutrients will be faster and the value of productive energy will be higher. The high crude fiber content causes poultry to feel full faster, so that it can reduce consumption because crude fiber is voluminous, less palatable, resulting in low consumption.

Curcumin compounds contained in *Curcuma* have antibacterial, anti-protozoa, antiviral, anticoagulant, antioxidant, antitumor, anti-carcinogenic properties that can regulate microbial activity by inhibiting the growth of pathogenic bacteria (*Escherichia coli*, *Staphylococcus aureus*, and *Staphylococcus epididymis*) and get function digestive enzymatic metabolic processes so that at the same time can increase digestive enzyme activity. Increased enzymatic digestion and regulation of microbial activity cause the absorption of protein to be absorbed quickly and well by the intestine so that the feed in the small intestine quickly goes out to the cloaca. Empty feed in the fine intestine will increase chicken appetite to consume more feed but added curcumin content in the ration it is not optimal to stimulate enzyme secretion and unable to reach the target organs which can affect the biological value of super kampong chicken protein. [6] state that the factors influence the digestion of protein are i) heating, ii) the size of food particles, iii) the presence of inhibitors. The higher protein content of feed ingredients, the higher the protein consumed so that the slower feed rate in the digestive tract of chickens and the higher protein digestibility and nitrogen retention produced. Nitrogen retention was not significantly affected by ration pattern factors, starter age, and sex, temperature, and humidity of the cage.

4. CONCLUSIONS

Based on this research, giving *Curcuma* as feed additive had a significant effect on body weight gain and final body weight of kampong super chicken but it had no significant effect on feed consumption, feed conversion ratio, carcass weight, abdominal fat weight, fat content meat, meat protein content, fat digestibility, crude fiber digestibility, protein biological value and nitrogen retention of kampong super chicken.

There were no significant differences between T0 and T1, but it was different from T2 and T3, and T2 showed no difference with T3 on body weight gain and final body weight. The best treatment in this study was T0 and T1, namely the addition of *Curcuma* 0 % and 0.33 %. From the conclusion, this research gives suggestion to use 0.33 % *Curcuma* as feed additive in the super kampong chicken feed for body weight gain and final body weight as preventive action.

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