Effect of turmeric-filtrate nanocapsules in ration on duck (Anas domesticus) production performance

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Abstract. This study aims to determine the best level of addition of turmeric filtrate nanocapsules in the ration to the performance of male local ducks. Complete randomized design of unidirectional pattern has been used, namely 7 treatments with 3 replications, each replication using 3 ducks. The seven treatments consisted of adding NPs in the ration: basic ration control (RD) without NP (T1), RD + 1% NP (T2), RD + NP 2% (T3), RD + NP 3% (T4), RD + NP 4% (T5), RD + NP 5% (T6) and RD + NP 6% (T7). The measured variable: a). Feed consumption, increase in body weight, feed conversion and live weight of ducks aged 10 weeks. Conclusion: the best level of nanoparticles or naocapsules of turmeric filtrate to be added to duck feed is 1%.

1. Introduction

One of the Indonesian government's policies that are directly or indirectly related to efforts to realize food security and security are: increased meat production and food diversification (Number 19 / Permentan / HK.140 / 4/2015). In the animal feed industry antibiotics are used to accelerate livestock growth and reduce feed convertion ratio or increase feed efficiency. An increase in the performance of chickens that received antibiotics was allegedly an indirect effect of these antibiotics in killing bacteria that produce toxic so that the growth of livestock is not disturbed besides that it can also increase the absorption capacity of nutrients by the intestinal wall due to depletion of the intestinal wall (Zuprizal, 2006). The use of this antibiotic turned out to leave a residue in the liver (Oramahi, 2005), the residue in the meat amounted to ± 50% of the gift and in the excreta / chicken manure that would pollute the environment (Wiyana et al., 1999). In order to support food security and security, efforts are needed to find synthetic antibiotic substitutes as feed additives. There are many kinds of feed additives that can replace the role of synthetic antibiotics, among others: probiotics, fitobiotics, oligosaccharides / prebiotics, enzymes, organic acids (Zuprizal, 2006).

Therefore, with the successful production of synthetic antibiotic substitute feed additives (turmeric NP) and its supporting tools are expected to reduce dependence on imports of feed / antibiotic additives, import of meat and livestock germs. Currently 65% of the total meat needs of the Indonesian people are filled with chickens, especially broilers, but we all know that all components of seeds, feed ingredients including feed additives in the

broiler industry are almost all imported. So far farmers have always been in a difficult position where feed prices have always risen but they cannot set the selling price of live livestock products. The selling price of live livestock fluctuates according to market prices, so it is necessary for farmers to be given the knowledge of processing livestock / meat products to increase the sale value. It is deemed necessary to find a solution to all of the above problems by starting local poultry cultivation such as ducks to provide meat and diversification of food consumption to increase the sovereignty / independence of the nation, reduce import dependency and save foreign exchange.

Turmeric rhizomes contain active ingredients of curcumin which can function to increase bile secretion, and increase pancreatic lipase activity, amylase, trypsin and chemotrypsin (Chattopadhyay et al., 2004). Besides that turmeric extract has activities as: antibacterial, anti-inflammatory (anti-inflammatory), antitoxic, antihyperlipidemia, and anticancer .. Sundari (2014) reported the administration of turmeric extract nanocapsules at a level of ,40.4% in the diet significantly increased protein, EPA and DHA meat chicken. This is possible because curcumin blocks COX and LOX in AA metabolism so that the enzyme Δ-5-desaturase increases the conversion of linolenic acid to EPA and DHA (Wall et al., 2010). At the same time it lowers cholesterol: blood, liver and meat are followed by increased cholesterol excretion in excreta (feces). The mechanism of curcumin in hypolipidemic as expressed by Zingg et al. (2013) as follows: curcumin increases lipid uptake in the intestine and decreases lipid biosynthesis and decreases adipose cell differentiation thereby decreasing size / weight. Curcumin increases bile production by taking lipids / cholesterol from tissues and increasing lipid metabolism through β-oxidation to heat / physical energy. Chitosan shows hypocholesterolemic activity with a mechanism to increase the excretion of bile acids and total steroids which triggers an increase in regulation of bile acid biosynthesis (Yau and Chiang, 2006). The administration of 0.4% NP from the ration also increased nutrient digestibility due to increased mucosal length as a place for secretion of digestive enzymes and absorption (Sundari, 2014). Turmeric NP liquid preparations have also been successfully applied in broiler chicken water as much as 2% can replace the use of synthetic antibiotics / commercial feed additives without adverse effects on meat performance and production (Zuprizal et al., 2015).

2. Materials and Methods

The study was carried out in step-1 of turmeric nanocapsule formulation using appropriate technology tools (TTG) engineered by a 20 L capacity mixer, in the Chemistry Laboratory, Mercu Buana University Yogyakarta (UMBY). Continued the application phase-2 to the ducklings test the production performance carried out in the experimental enclosure of the UMBY Garden and Livestock Estate. Before the research was carried out, both the room, cage and equipment were disinfected with the Rodalon Brand disinfectant. One week before the treatment period to avoid stress of cattle adapted to the place and treatment conditions were given a commercial ration substituted with the treatment ration. Complete random design of unidirectional patterns has been used in this study. Male-local ducks, mojosari type aged 6-10 weeks, as many as 63 animals have been divided randomly into 7 treatments and each treatment has 3 replications, each replication unit is filled with 3 experimental animals placed in a battery cage measuring pxlxt = 100 x 50 x 50 cm. Each cage has one feed and one drinking place. Feed and drink are given ad-libitum. Feed ingredients / basic ration consisted of: milled yellow corn, fish meal, soybean meal, rice bran, palm oil, limestone flour, and masamix, with total nutrient content (crude protein 17.54%, ME 3094.37 kcal / kg) The treatment given was the addition of filtrate-turmeric nanocapsules (turmeric juice) into the basic ration (RD) at 7 treatment levels, namely T1 = RD + 0%, T2 = RD + 1%, T3 = RD + 2%, T4 = RD + 3 %, T5 = RD + 4%, T6 = RD + 5%, T7 = RD + 6%.

Turmeric filtrate nanocapsules (sari-turmeric) are made by: 4 kg turmeric rhizome peeled and diblanching with 0.05% citric acid solution (2 g) and put into boiling water for 5 minutes. Enter turmeric rhizome and 5 L distilled water into a blender-mixer machine, mashed for 30 minutes, filtered and obtained turmeric filtrate. Turmeric filtrate, put back into the blender-mixer. Then it was encapsulated with 50 g chitosan which had been dissolved in 4 L of 2% citric acid, by blending the mixer for 30 minutes. Then cross-linked by adding STPP 25g which has been dissolved in 1 L of distilled water, by mixing it into a large L-20 blender-mixer (tool) for 30 minutes, the results obtained are turmeric nanocapsules of 100% liquid filtrate preparation. These nanocapsules have been

characterized by a particle size analyzer (PSA) Becman Coulter DelsaTM Nano which uses Dynamic Light Scattering (DLS) technique in Serpong herbal Nanotech. The results obtained 31.80% of particles measuring 542nm, while the results of measurements with SEM in LIPI Gunungkidul produce 538nm particle size (Figure 1). This nanocapsule liquid is mixed into the ration according to treatment, then the ration for pellets and without drying process can be directly given to ducks.

The variables measured are: Every week livestock are weighed to measure body weight gain (PBB), as well as feed consumed next feed conversion can be calculated by dividing feed consumption with the United Nations. Body weight. Increase / increase in body weight was obtained by reducing livestock weight at the end of the week with initial body weight (gram / head / week) during the study (Fadilah, 2005). For the final body weight is the result of duck weighing at the end of the study, age 10 weeks. Feed consumption is calculated on each week of maintenance by finding the difference from the feed given with the remaining food consumed, then divided by the number of livestock per group (gram / head / week) (Fadilah, 2005). Feed conversion was calculated during 4 weeks of age, which was obtained by dividing the amount of food spent (Feed Intake = FI) with body weight gain (GAIN) per week of maintenance (Fadilah, 2005).

Performance data (body weight, increase in body weight, feed conversion and life weight of 10 weeks) were analyzed by a complete randomized design variance analysis of unidirectional patterns, if there were significant differences followed by Duncan's test (Subali, 2010) with the help of a computer SPSS-16.

3. Results and discussion

By using a blender-mixer with a capacity of 20L with a power of 1 HP and 6 blades 4-6 cm long which combined in 3 positions down, middle and up so that it can reach the material well, it has been successfully produced turmeric filtrate nanocapsules which are encapsulated with chitosan and crosslinked with sodium tri poly phosphate (STPP). Morphology of the turmeric filtrate nanocapsules as a result of shooting with Scanning Electrone Microscope (SEM) as in Figure 1, shows an amorphous shape with a particle size of 538nm.

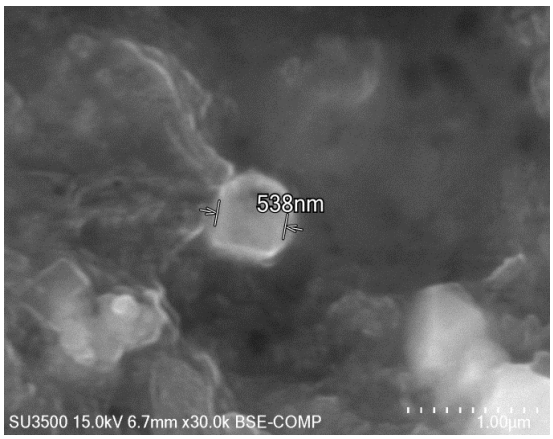

Figure 1. Micrographs using Scanning electron microcrope (SEM) magnifikationi 30.000 x, amorf morfologi with particle size 538nm.

The results of the morphology of nanocapsules using different electron microscopy devices between TEM and SEM gave different results. Sundari (2014) reported that the nanocapsules of turmeric extract made in powder preparations, which then before being photographed with TEM were melted again with ethanol giving a spherical picture as shown in Figure 2. The size depends on the formula and the concentration of the ingredients. From Figure 2, it can be seen that curcumin is coated

in chitosan capsules (invisibility) so that it shows a spherical spherical morphology. Whereas in Figure 1, the results of SEM photos are images of particle surfaces (there is no obvious presence of chitosan coated curcumin).

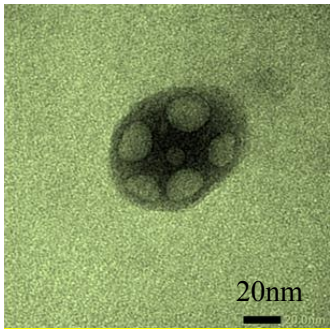

Figure 2. Micrograph nanocapsule by TEM

Average data on performance results include: feed consumption, body weight gain, and live weight of 10 weeks (harvest weight) of male local ducks from the results of the treatment of turmeric nanocapsule addition in feed P1, P2, P3, P4, P5, P6, P7, successively is 1,325; 1,530; 1,266.67; 1,463,33; 1,521.67; 1,505; 1,466.67 grams / head. Complete results in Table 6.

The results of the analysis of variance showed that the addition of turmeric nanocapsules in the ration had no significant effect (P> 0.05) on feed consumption, FCR and live weight of male local ducks. However, the mean value of giving 1% NP-filtrate gave the highest life weight compared to all treatments. This result is expected because the amount of feed consumption is relatively the same so that the weight of life produced is not significantly different. While the results of the analysis of variance for increasing body weight showed a significant difference (P <0.05), the addition of level 1% Nanocapsules or P2 showed the best results.

Table 1. Feed consumption, increase in body weight, feed conversion and live weight of ducks plus various levels of turmeric filtrate nanocapsules in rations

Treatment, nanocapsule level in ration (%) (%)	Feed consumption^{ns} (g)	Increased body weight* (g)	FCR^{ns}	Life weight is 10 weeks old ^{ns} (g)
T1, 0%	138.38	106.33^{a}	1.32	1325,00
T2 , 1%	149.43	141.33^{b}	1.06	1530,00
T3, 2%	148.86	118.33^{ab}	1.27	1466,67
T4, 3%	142.99	114.33^{a}	1.26	1463,33
T5, 4%	138.73	114.33^{a}	1.22	1521,67
T6, 5%	143.24	127.67^{ab}	1.13	1505,00
T7, 6%	160.17	118.67^{ab}	1.35	1466,67

Keterangan:^{ns}(non significant),*= ^{ab}superskrip different in the same column shows significant differences (P<0,05).

Where the amount of ration consumed will determine the weight of life obtained, the more rations consumed, the greater the life weight produced, as well as the carcass weight (Rev. 1997). This is in agreement with Suwarta (2014) that the amount of feed consumption affects the availability of nutrients for quail growth so that it will affect life weight.

The ration added with turmeric NP with a percentage of 0-6% in the study as shown in Figure 9. This shows that the increase in body weight is seen at the level of 0-1%, then decreases at 2-3%, and increases again at the level> 4 %. Level 1% of turmeric NP (low level) in the ration given to ducks,

provides the most optimal level with the highest BB achievement. This is because the ration added with 1% of turmeric NP can work optimally in spurring digestion and feed utilization and better performance for meat muscle formation compared to other treatments. This is in accordance with Sinaga's (2010) opinion that in mice and rabbits, curcumin can stimulate increased relaxation of the small intestine which results in longer food in the small intestine and stimulates hormone secretion from brunner glands in the small intestine. Curcumin is a phenolic compound that can change the permeability of the cytoplasmic membrane (protein damage) which causes leakage of nutrients from cells so that bacterial cells die or are stunted (Al-Rubiay et al., 2008). Nanokurkumin is far more effective as an antibacterial than curcumin, observations by TEM show these particles enter bacterial cells by completely breaking the cell wall causing cell death (Bhawana et al., 2011). Curcumin in chronic toxicity studies on rat test animals proved to be safe in the stomach because it is selective in COX-2 enzyme (Jurenka, 2009). The administration of curcumin can increase the activity of the liver enzyme glutathione S-transferase (Nishinaka et al., 2007) as a toxin detoxifying enzyme. This is in agreement with Nova et al., (2015) that the low content of saponins in turmeric can still be tolerated by ducks at low levels, so as not to interfere with digestion and growth in ducks.

Sundari (2014) said that giving powder turmeric NP> 0.2% in broiler chickens causes a decrease in growth and an increase in FCR means that it has begun to interfere with normal body metabolism. The administration of NP began to cause a significant decrease in feed consumption at levels> 0.4%, indicating that the diet began to be disliked (toxic / excess NP). Low doses of curcumin (1, 10 and 25 μM) stimulate normal cell proliferation of human fibroblasts and human fibroblast and micro-vascular endothelial cells (hMVEC) which at higher doses (50, 60, 75 and 100 μM) inhibit them (Kostandova and Pamula, 2005).

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