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Consumer Preferences Organoleptically Towards Broiler Chicken Supplemented with Nanoencapsulated Liquid Turmeric Extract in Drinking Water

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Abstract. The purpose of this research was to investigate the effects of nanoencapsulation liquid turmeric extract (NLTE) supplementation as a phytobiotic on organoleptic quality of broiler meat. The research was conducted with a directional pattern completely randomized design. Eighty-four broiler chickens were raised from day old (DOC) to 42 days old chick. From DOC to 14 days old, chicks were fed with commercial feed (ME 3,100 kcal/kg; CP 22%; Ca 1%; P 0.75%). During 15-21 days of age, chicks were given a mixture commercial feed and basalt feed (ME 3,201.77 kcal/kg; CP 20.21%; Ca 0.90%; and P 0.43%). At 22-42 days old, they were given treatments by basal feeding. Seven treatments were replicated 3 times consisted of 4 broiler chickens for each replication. The treatments were positive control (P1), negative control (P2), water + NLTE 2% (P3), water + NLTE 4% (P4), water + NLTE 6% (P5), water + NLTE 8% (P6), and water + NLTE 10% (P7). The results showed that supplementation NLTE significantly increased (P<0.05) the taste of broiler meat. However, it did not show a significant influence (P>0.05) on the texture, colour, tenderness, and preference of meat.
Keywords: broiler meat, liquid turmeric extract, nanoencapsulation, organoleptic

Abstrak. Tujuan penelitian ini adalah untuk mengetahui efek penambahan nanoenkapsulasi ekstrak kunyit sediaan cair (NEKC) sebagai fitobiotik terhadap kualitas organoleptik daging ayam broiler. Penelitian dilakukan dengan rancangan percobaan acak lengkap pola searah. Ayam broiler 84 ekor dipelihara sejak usia 0 hingga 42 hari. Umur 0-14 hari diberi pakan komersial (ME: 3100 kcal/kg; CP 22%; Ca 1%; P 0,75%). Umur 15-21 hari diberi pakan campuran komersial dan basal (ME 3201,77 kcal/kg; CP 20,21%; Ca 0,90%; P 0,43%). Umur 22-42 hari dimulai perlakuan dengan diberi pakan basal. Tujuh perlakuan dibuat dengan masing-masing 3 replikasi dan 4 ekor di setiap replikasi, dengan formulasi pemberian NEKC sebagai berikut; kontrol positif (P1), kontrol negatif (P2), air + NEKC 2% (P3), air + NEKC 4% (P4), air + NEKC 6% (P5), air + NEKC 8% (P6), dan air + NEKC 10% (P7). Hasil penelitian menunjukkan pemberian NEKC memberikan pengaruh nyata (P<0,05) terhadap rasa daging ayam broiler menjadi lebih disukai, tetapi tidak menunjukkan pengaruh nyata (P>0,05) terhadap tekstur, warna, kekenyalan, dan penerimaan daging.
Kata Kunci: daging ayam broiler, ekstrak kunyit cair,nanoenkapsulasi, organoleptik

Introduction

Broiler chicken is one of the national primary commodities as chicken meat producer. The rapid growth of chicken, low feed conversion and directly visible results as regular income has attracted many people to become broiler chicken farmer. Data from Badan Pusat Statistik Indonesia (2018) shows that throughout 2009 to 2017 the number of broiler chicken increased by 65,5%, from 1.026.378.580 chickens to 1.698.368.741 chickens. Based on this finding, we can also say that the increasing number of broiler chicken population indicates an increase in market demand.

Unfortunately, broiler chicken whom we know as national primary chicken meat commodities producer is still covered in weakness since antibiotic residues was found in its meat (Widiastuti, 2008). The antibiotic residues that was found in the chicken meat produced become a problem that push the Ministry of Agriculture to release Agricultural Decree No. 14 Year of 2017 on classification of veterinary medicine in which contains restriction on the use of antibiotics in mixed

animal feed, including broiler chicken. The antibiotics themselves was originally used as growth promotor (Daud *et al.,* 2007; Kompiang, 2009) the effect of *growth promoting* in antibiotics has a close relationship with their ability to inhibit pathogenic microbes in the digestive tract (Dono, 2012) and automatically increase the absorption of nutrients in the small intestine and resulted in optimal performance. But, unfortunately, as mentioned above, the antibiotics in the chicken meat are remains after as residues and potentially harm if consumed by human.

The previous condition showed that broiler chicken meat that regularly feed with antibiotics mixture was organoleptically acceptable by consumer. Based on that condition, research on feed material is necessary, especially the one that can substitute the role of antibiotics as growth promotor, as well as producing high quality organoleptic chicken meat to keep the consumer's preferences. For this, some of plants are proven to contain active compound called Phytobiotics that principally can replace the role of antibiotics as growth promotor, and one of them is turmeric *(Curcuma domestica)* (Napirah *et al.,* 2013).

Curcumin is an active substance found in turmeric (Sinurat *et al.,* 2009) with its main activity is as an antibacterial. Bhawana *et al.* (2011) stated that the mechanism of antibacterial action on curcumin is investigated by micrograph electron transmission (TEM) analysis, and revealed that these particles enter the bacterial cell wall by completely damaging the cell wall, causing cell death. In addition to antibacterial function, curcumin compounds can also affect the sensory on broiler chicken meat. Suryaningsih *et al.* (2012) stated that curcumin can seep into the chicken meat, strengthening the meat color along with higher concentration. Turmeric also contains essential oil compounds that can affect the taste of the meat.

In addition to all of its benefits, one thing that claimed to be curcumin weakness is its low bioavailability when entering the digestive tract of broiler chicken. Therefore, a special technology is needed to maximize curcumin role. Research by Sundari (2014) shows that curcumin added by chitosan biopolymer compounds and STPP (Sodium Tripolyphosphate) in the form of nanoparticles is effective to increase dry matter, protein and fat digestibility. Martien *et al.* (2012) explains that a simple method called ionic gelation can produce chitosan nanoparticles. This method works by producing ionic bounds between positively control chitosan and negatively control drugs. Mostly, the system formed tends to leave a group of ammoniums to repel each other. Therefore, a cross linker is needed to stabilize the remaining positive control. The cross linker we can use is STPP.

The research on nanoencapsulated liquid turmeric extract conducted by Zuprizal *et al.* (2015) with the same method shows the increase on feed consumption and body weight gain of broiler chicken. The meat quality produced provided the decrease on the meat cholesterol (Zuprizal *et al.,* 2015) and the increase on the meat dry matter (Hidayat *et al.,* 2017). Based on the application administered, it can be identified that the transmission of curcumin as active compound in the turmeric will be optimal for antimicrobial activity in the intestine, and eventually will also be optimal when entering the muscle cells. Therefore, the resulting meat will provide better difference especially for its sensory quality as one of consumer's preference indicators.

Materials and Method

In Vivo Experiment Nanoencapsulation Liquid Turmeric Extract (NLTE) in Drinking Water

Male broiler chickens were raised for 42 days. From day 0 to day 14, chicks were given commercial rations with its nutrient content: ME: 3.100 kcal/kg; CP 22%; Ca 1%; P 0,75%.

From day 15 to day 21, chicks were given commercial mixture feed and basalt starter feed (Table 1), it was useful in adaptation of antibiotics-free basalt feed consumption until fully used basalt feed when NLTE was given. As much as 84 broiler chickens aged 22 days were then divided randomly into 7 groups of treatment. Each treatment consisted of 3 replications with 4 broiler chickens in each replication. Treatments were given for 21 days until they aged 42 days. Finisher basalt rations feeding (Table 1) during treatments were done in ad libitum ways. Seven treatments were categorized based on the supplementation of NLTE in drinking water, detail was: P1 (positive control: water + bacitracin 12 mg/1000ml); P2 (negative control: water); P3 (water + NLTE 2%); P4 (water + NLTE 4%); P5 (water + NLTE 6%); P6 (water + NLTE 8%); and P7 (water + NLTE 10%)

Step by step in making NLTE: 1) Fresh turmeric, peel the skin; 2) The peeled turmeric then bleach by soaking it in 0,05% citric acid solution in 100^{o}C temperature for 5-10 minutes, then drained; 3) The drained turmeric mixed with aquades and blended until smeared (400gr of fresh turmeric mixed with 500ml aquades); 4) blended turmeric are then strained to separate its dregs and filtrate; 5) Filtrate of turmeric extract then added by chitosan as much as 5 g which had previously been dissolved in 400 ml of citric acid buffer pH 4 with the help of magnetic stirrer; 6) Filtrate of turmeric extract + chitosan then added by STPP as much as 2.5 g that previously dissolved in 100 ml aquades with the help of magnetic stirrer.

Table 1. Basal rations composition and content of nutrient*

Feed Ingredients	Starter (%)	Finisher (%)
Yellow milled corn	52.00	52.00
Rice bran	10.00	12.50
Soy meal/SBM 45	21.00	19.50
Fish flour 55	12.00	9.50
Palm oil	3.70	5.10
Limestone	0.13	0.30
NaCl salt	0.08	0.20
Masamix **	0.44	0.10
L-Lysine HCl	0.35	0.40
DL Metionin	0.30	0.40
Total	100.00	100.00
Content of Nutrient		
Crude protein (%)	22.13	20.21
ME (kcal/kg)	3143.99	3201.77
Crude Fat (%)	5.30	5.41
Crude Fiber (%)	3.14	3.35
Calcium (%)	0.92	0.90
Available Phosphor (%)	0.50	0.43
Lysine (%)	1.51	1.41
Metionin (%)	1.41	1.35

Note:

*Normal chicken broiler age 3-6 weeks nutrient needs is (NRC, 1994): protein 20%; Lys 1,0%; Met 0,38%; energy 3200 kcal/kg, Ca 0,9%; P av 0,35%.

** Masamix composition per kilogram : vit A 810000 IU, D3 212000 ICU, E 1,8g, K3 0,18g, B1 0,112g, B2 0,288g, B6 0,3g, B12 0,0036 g, Co 0,028 g, Cu 0,5g, Fe 6,0g; Mn 6g; Iod 0,1g; Zn 5g, Se 0,025g, DL-Met 212,5g, L-Lys 31g, Folic Acid 0,11g, Pantothenic acid 0,54g. Niacin (vit B3) 2,16g, CholinCl60% 75g.

Organoleptic Data Collection of Broiler Chicken Meat

Organoleptic data sample collection was done by choosing 1 chicken randomly from each treatment replication and cut its chicken breast. The chicken breast was removed its skin and chopped in 2 x 5 cm dimensions, then cooked in boiling water for 5 minutes. Organoleptic data covering taste, texture, color, tenderness, and consumers preferences. For consumers' preferences, 20 panelists were involved and each of them was given sample of chicken meat. Panelists had no information before about chicken meat samples that were being on experiment. Evaluations from panelists were then analyzed by using Kruskal Wallis method. The differences on mean will be tested on advanced experiment with *Orthogonal Contrass Test* with the help of SPSS 16 *software*.

Results and Discussion

Generally, the results obtained show no significant difference (P>0.05) on the texture, color, tenderness, and preferences of broiler chicken on each treatment. A significant difference can be detected in the taste of broiler chicken meat (P<0,05) with rate number given by panelists shows their sensorics in the taste of broiler chicken meat. Organoleptic test results can fully be seen in Table 2.

Taste is one of sensorics indicators, with the help of tongue with thousands of taste buds in it we can taste many foods. Taste is part of flavor. The experiment showed significant different (P<0.05) between NLTE concentration of 8% (P6) and 10% (P7) with taste value rate was higher and being liked by panelists compared to broiler chicken meat with positively control antibiotics treatment (P1), negatively controlled (P2), and NLTE treatment with lower concentration i.e. 2% to 6% on P3, P4, and P5. Ponte *et al.* (2004) shows that taste is the most influential thing when someone wants to come back to buy the chicken meat again, if they feel a bad taste at first try, they will not come back second time. From this, we can learn that keeping or increasing sensorics values i.e. chicken meat taste become an important thing to create satisfied loyal customers.

Chicken meat taste also has a close relationship with rations feed consumed. The research conducted by Wang *et al.* (2015) shows that the application of turmeric extract with dosage 300 mg/ kg of feed resulted in the increase on the antioxidant activity marked by the increase on the enzymatic activity of superoxide dismutase (SOD) and glutathione peroxide (GSH-Px). This curcumin's activity of antioxidant is effective to inhibit the lipid peroxidation compounds (Zhang *et al.,* 2015). The existence of the lipid peroxidation compounds inhibition resulted in broiler meats that are inhibited from rancidity and the taste will be better.

Table 2. Broiler Chicken Meat Organoleptic Test Result

Variables	Treatment						
	P1	P2	P3	P4	P5	P6	P7
Taste*	3.3[a]	3.15[a]	3.3[a]	3.2[a]	3.3[a]	3.6[b]	4[b]
Textures[ns]	3.15	3.05	3.25	3.4	3.4	3.65	3.7
Color[ns]	2.2	2.6	2.65	2.6	2.75	3.1	3
Tenderness[ns]	2.9	3	2.75	3	3.2	2.7	2.6
Preferences[ns]	3.3	3.3	3.5	3.45	3.25	3.6	3.95

Note:
*: significant (P<0.05)
[ab]: superscript in the same line shows a significant difference (P<0.05)
[ns]: non significant

Soeparno (2011) explains that flavor can be changed if poultry consumes ingredients containing secondary compound, such as tannin condensation and volatile oil. The provision of

an antioxidants compound like Vitamin E can increase the resistance level of meat products towards oxidations. Those antioxidants function also contained within curcumin as active compound on turmeric. Another factor that influence the taste on meat is poultry sex and variety of livestock (Omojola, 2007)

The results obtained especially on color and texture of broiler chicken meat had similarities with no significant difference (P>0.05) at each treatment, in spite of a tendency to increase the texture value and higher color in NLTE treatment along with increase in concentrations (P6 and P7) compared to other treatment. Color is a factor that can attract consumers' interest at their first sight when choosing chicken meat. Color is a sensorics factors that can be capture effortlessly by human sense: the eyes. From a distance, human eyes can easily recognize to later give signal to brain and shortly after, drawing conclusion whether the chicken meat is good or not. Soeparno (2011) explains that the primary determinant of meat color is the concentration of meat pigment myoglobin and belongs to sarcoplasmic protein. Amalia (2017) explains that broiler chicken meat texture can be seen in its fiber, small and smooth. Based on the above explanations, the supplementation of NLTE in this research has not been able to change the myoglobin pigment concentration and broiler chicken meat fiber.

Sensorics experiment on the tenderness of chicken meat showed insignificant different (P>0.05) on each treatment even though there was a tendency of increase in tenderness rate on NLTE with up to 6% concentration (P5). However, the level of tenderness tends to decrease in higher concentration of NLTE (8% (P6) to 10% (P7)). Omojola (2007) explains that tenderness is identified as primary point in evaluating food quality, that would likely become a reason for consumers to come back and buy again. This is considered as logic, remembering that meat tenderness will ease the human teeth in chew the meat. A meat that is not tender will badly impacted in mechanical digestive process that are done by teeth and mouth. This is in line with Kerth explanation (2013) which is the most common factor in determining tenderness of freshly cooked meat associated with the ease of teeth in tearing or suppressing and fragmentation. The results also obtained at panelist preferences on sensorics experiment of broiler chicken breast showed no significant difference (P>0.05) at each treatments, although there was a tendency of higher preferences value on chicken meat with high concentration of nanoencapsulation turmeric extract which is 8% (P6) and 10% (P7). This condition indicated that generally there was no decrease on consumers' preference towards broiler chicken meat with NLTE supplementation in its drinking water.

Conclusions

The addition of Nanoencapsulated liquid turmeric extract (NLTE) into the drinking water as an alternative to replace the antibiotic growth promotor (AGP) at the broiler chicken farming resulted in better taste quality of broiler meats and as well as for the other sensory quality such as texture, color, tenderness, and consumer preferences organoleptically.

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