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The Influence of Nano-Encapsulation of *Melastoma malabathricum* L. Fruit Extract to Lipid Profile of Broiler Chicken

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ABSTRACT

The aim of this research was to examine the impact of nano encapsulation of *Melastoma malabathricum* L. fruit extract as feed additive that was given through drinking water towards lipid profile of broiler chicken. Experimental design used in this research was completely randomized design using six increment treatments of *Melastoma malabathricum* L. fruit extract to the drinking water of the chicken each with five repetitions. Detail of treatment rations were as follow: T0 drinking water treatment without feed additive (negative control), T1 drinking water treatment + 0.2 mg/kg body weight simvastatin (positive control), T2 drinking water treatment + 1.5% *Melastoma malabathricum* L. fruit extract, T3 drinking water treatment + 3.0% *Melastoma malabathricum* L. fruit extract, T4 drinking water treatment + 1.5% nano encapsulation of *Melastoma malabathricum* L. fruit extract, T5 drinking water treatment + 3.0% nano encapsulation of *Melastoma malabathricum* L. fruit extract. Observed Parameters were the blood lipid profile, cholesterol of meat and crude fat of meat. The results showed that adding the nano encapsulation of *Melastoma malabathricum* L. fruit extract did not give significant effect ($P>0.05$) on blood lipid profile and crude fat of the thigh and breast of the broilers. Addition of nano encapsulation of *Melastoma malabathricum* L. fruit extract gives real impact ($P<0.05$) toward reduction of broiler's meat cholesterol. The conclusion of this research is that giving nano encapsulation of *Melastoma malabathricum* L. fruit extract is able to improve lipid profile of broiler, which is in the amount of meat's cholesterol.

Keywords: Lipid profile of broiler chicken, *Melastoma malabathricum* L. fruit extract, Nano-encapsulation

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Introduction

High amount of lipid, especially on the chicken's meat is not quite good to be consumed by humans. One of the ways to overcome that problem is by giving phytobiotic during chicken's care. Phytobiotic is feed additive comes from plant which is able to give good impact towards livestock. One of the plants that can be the source of phytobiotic is senduduk (*Melastoma malabathricum* L.).

Melastoma malabathricum L., especially on its fruit contains high anthocyanin (Rifkowati and Wardanu, 2016). Anthocyanin is water soluble pigment contained in various plants, has conjugated double bunches, which make it to be an antioxidant as a preventive of free radical (Tazzini, 2014). Ferry *et al.* (2015) stated that anthocyanin has the ability to hamper fat synthesis by hampering the work of *HMG CoA reductase* in the forming process of *Asetyl CoA* becomes *mevalonic* which is the early step of cholesterol synthesis (fat) inside the body. The decreasing of fat synthesis inside the body will give impact to the fat that is distributed to all of

body tissue is decreased, so it will give impact to the concentration of LDL (Low Density Lipoprotein) and HDL (High Density Lipoprotein) inside blood. It indirectly will also give impact to broiler lipid profile, on the blood lipid profile (LDL, HDL, cholesterol total and Triglyceride), the content of fat and cholesterol of broiler's meat, abdominal fat, and visceral fat of the broiler.

The ability of anthocyanin is excellent when consumed but it has lack which is unstable toward pH changes (Nielsen *et al.*, 2003). It is not good because in the chicken's digestive system there will be pH changes (low pH) especially in proventriculus, so that it needs an effort to protect anthocyanin which will make it able to be maximally absorbed in the jejunum and ileum. One of the ways that can be done to protect anthocyanin is by using nano encapsulation.

Nano encapsulation is a technology of coating towards compound of solid, liquid, and gas by using upholstery to protect the material of filling substance (Arumsari, 2015). The simple nano encapsulation is by using method of ionic gelation. Ionic gelation is the characteristic of interaction between cation (chitosan) and

polinon such as Sodium Tripolyphosphate (STPP) (Ningsih, 2016).

The aim of this research was to examine the effect of *Melastoma malabathricum* L. fruit extract as feed additive that is given through the drinking water to lipid profile of broiler. The significance of this research is the use of *Melastoma malabathricum* L. fruit extract with the main content of anthocyanin is expected to reduce the lipid profile of broiler.

Materials and Methods

Materials used in this research are *Melastoma malabathricum* L. fruit, chitosan, STPP, ethanol, acetate acid, citrate acid, aquades, statin with manufacturer brand "Simvastatin" from Kimia Farma, DOC broiler (MB 202 Platinum male sexing from PT JAPFA COMFEED TBK), manufacturer feed with manufacturer brand BR 1 from PT JAPFA COMFEED TBK. The specification of the mentioned feed can be seen on Table 1.

Experimental design that was used in this research was completely randomized design using 6 increment treatments of *Melastoma malabathricum* L. fruit extract in the chicken's drinking water with each repeat 5 repetitions in which every repetition consists of 7 chickens. The details of treatment are as follows: T0 = drinking water without feed additive (negative control), T1 = drinking water + 0.2 mg/kg body weight simvastatin (positive control), T2 = drinking water + 1.5% *Melastoma malabathricum* L. fruit extract, T3 = drinking water + 3.0% *Melastoma malabathricum* L. fruit extract, T4 = drinking water + 1.5% nano encapsulation of *Melastoma malabathricum* L. fruit extract, and T5 = drinking water + 3.0% nano encapsulation of *Melastoma malabathricum* L. fruit extract. The basis of extract levels is based on Choiri *et al.* (2017).

Observed parameters were the content of blood lipid profile, cholesterol and crude fat of meat. The research was done in 3 stages, viz.: 1) preparation stage; 2) implementation of the research stage; and 3) data taking stage.

Preparation stage

Preparation stage consists of the extraction of *Melastoma malabathricum* L. fruit with the method of maceration, the making of nano encapsulation of *Melastoma malabathricum* L. fruit

extract, feed preparation, and stable preparation as well as the laboratory.

Making of *Melastoma malabathricum* L. fruit extract

Maceration method refers to the research of Fatonah *et al.* (2016) which used ethanol-citrate acid solvent 3% with ratio solvent 85:15. The macerate was filtered then steamed by using waterbath at 60°C (Memmert, Schwabach, Germany) until it dried. And then the result of the steaming was dissolved with aquades, so that *Melastoma malabathricum* L. fruit extract 2% solution was formed.

Making of nano encapsulation

Nano encapsulation of *Melastoma malabathricum* L. fruit extract was prepared initially by dissolving chitosan as much 3.816 g in the acetate solution 2.5% with 610 ml. The dissolving process is using strirrer (C-MAG HS 7, IKA, Selangor, Malaysia) for 30 minutes. After that, making STPP (Sodium Tripolyphosphate) solution 0.75% by dissolving STPP as much 0.125 g in aquades 16.7 ml. Nano encapsulation was made by trial and error by making comparison between chitosan solution : *Melastoma malabathricum* L. fruit extract solution: STPP solution. The result of nano encapsulation of *Melastoma malabathricum* L. fruit extract that was chosen is the comparison of the three solutions which did not show agglomeration after centrifuged (PLC 03, Germany Industrial Corp., Taipe, Taiwan) 800 rpm for 30 minutes.

Implementation stage

The implementation stage consists of distributing manufacturer feed for the chicken in the age of 1-35 days, then continued by distributing the treatments from the age of 22-35 day. The treatments (T0, T1, T2, T3, and T4) were given through the drinking water. The amount of treatment distribution was counted based on the broiler drinking water needs. The broiler drinking water need was calculated referring to Esmail (1996); the drinking water need is two times of feed need.

Data taking stage

A chicken was chosen randomizely each replications of the treatments to take blood sample and meat sample. Taking the blood sample and analysis blood profile refer to the research of

Tabel 1. The nutrition facts of feed

| Nutrient | Contents |
|----------------------------|---------------|
| Crude protein (%) | 21.00 – 22.00 |
| Crude fat (%) | 4.08 - 8.00 |
| Ash (%) | 3.00 - 5.00 |
| Calcium (%) | 0.90 - 1.20 |
| Phosphor (%) | 0.70 - 0.90 |
| Metabolic energy (kcal/kg) | 2950 - 3050 |

Source: PT JAPFA COMFEED TBK, 2017.

Hartoyo *et al.* (2005). The process was started by cleaning the chicken's wing with alcohol. Taking the chicken's blood sample was through the vena that was on the under of the chicken's wing section and was taken using disposable syringes as much 2 ml. The blood sample that was obtained then put it into collection tube, saved in iced thermos bottle.

The meat sample was the breast meat and thigh that were separated from the bone. The two of the meats were refined and saved in the freezer until their fat and cholesterol contents were analyzed. The analysis of fat content was measured by soxhlet method by using ether and the analysis of cholesterol content was measured by GC (gas chromatography).

Result and Discussion

Blood lipid profile

The impact of nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution towards blood lipid profile of the broilers can be seen on Table 2. The average result of LDL, HDL, cholesterol, and triglyceride level of broiler's blood in this research is as much 50.95; 54.81; 116.37 and 38.28 mg/dl. That result is a bit different compared to the research of Azim *et al.* (2014) which stated that LDL, HDL, cholesterol and triglyceride level inside broiler's blood is as much 96.41; 24.64; 121.05 and 128.89 mg/dl.

Based on the statistic of nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution there is no significant effect ($P > 0.05$) towards blood lipid profile (LDL, HDL, cholesterol and triglyceride) of the broilers. It is caused by homeostatic of the lipid profile inside the blood. This process is affected by thyroid

hormone. It plays an important function in regulating cholesterol metabolism and lipoprotein homeostasis (Aluwong *et al.*, 2013). This is in line with the research of Purwanti (2015) which observed the effectiveness of the use of phytobiotic turmeric extract and garlic as additive feed to increase the production performance of broilers, one of which is the blood lipid profile. The result of the research showed that phytobiotic distribution does not give impact to the blood lipid profile of broiler.

Crude fat and cholesterol of meat

The impact of nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution towards cholesterol and crude fat contents of the broiler's meat can be seen on Table 3. The average of the research result about the content of crude fat on the thigh and breast meat are as much 2.57% and 0.48%. That result is lower compared to the research of Hashim *et al.* (2013) which stated that crude fat content on fresh thigh and breast meat areas as much 18.42% and 1.71%. The average of the research result is the cholesterol of breast meat and thigh meat is as much 48.56 and 10.56 mg/kg. That result is lower compared to the research of Oliviera *et al.* (2016) which stated that cholesterol level on the breast meat and thigh meat of the broiler is as much 49.12 and 64.12 mg/100g of fresh meat.

The statistic shows that nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution towards crude fat on breast and thigh meat of broiler does not give significant effect ($P > 0.05$). That is estimated caused by the *Melastoma malabathricum* L. fruit extract only gives influence to the cholesterol metabolism inside the body. *Melastoma* is known to have active substance content named

Table 2. The impact of nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution towards blood Lipid profile of broilers

| Treatments | LDL ^{ns} | HDL ^{ns} | Cholesterol ^{ns} | Triglyceride ^{ns} |
|------------|-------------------|-------------------|---------------------------|----------------------------|
| | -----mg/dl----- | | | |
| T0 | 45.64±11.41 | 54.10±12.39 | 113.68±24.61 | 44.62±30.57 |
| T1 | 44.98±14.76 | 56.38±7.57 | 115.68±10.64 | 32.07±7.60 |
| T2 | 65.68±18.29 | 50.86±6.70 | 135.50±18.93 | 37.84±30.75 |
| T3 | 49.78±19.49 | 54.68±17.36 | 112.68±26.06 | 38.30±10.51 |
| T4 | 53.82±4.22 | 47.52±16.51 | 107.82±11.69 | 46.04±19.96 |
| T5 | 45.80±12.76 | 65.30±9.85 | 112.86±25.92 | 29.82±9.66 |

ns: non significant

Table 3. The impact of nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution towards cholesterol and crude fat on broiler's meat.

| P | CFBM ^{ns} | CFTM ^{ns} | CBM | CTM |
|----|--------------------|--------------------|--------------------------|-------------------------|
| | -----%----- | | -----mg/100 g----- | |
| T0 | 0.67±0.24 | 3.01±1.44 | 79.57±17.13 ^d | 16.55±5.92 ^c |
| T1 | 0.32±0.07 | 1.73±0.79 | 6.72±3.64 ^a | 12.56±0.41 ^b |
| T2 | 0.35±0.24 | 2.95±1.45 | 92.50±14.24 ^d | 10.20±1.70 ^b |
| T3 | 0.61±0.40 | 2.41±1.33 | 61.82±15.39 ^c | 6.76±1.16 ^a |
| T4 | 0.39±0.19 | 2.64±0.80 | 37.11±13.53 ^b | 4.66±0.29 ^a |
| T5 | 0.55±0.19 | 2.70±1.21 | 13.65±9.11 ^a | 12.56±0.32 ^b |

the superscript in the same column shows a noticeable difference

- P = treatments
- CFBM = crude fat of breast meat
- CFTM = crude fat of thigh meat
- CBM = cholesterol of breast meat
- CTM = cholesterol of thigh meat

anthocyanin (Arja *et al.*, 2013). This anthocyanin has the ability to inhibit cholesterol synthesis inside the body. Anthocyanin has the ability to hamper the performance of 3-hydroxy-3-methylglutaryl coenzyme A reductase (HMG Co-A reductase). That enzyme catalyzing the change HMG Co-A to be mevalonic acid which is the early step of cholesterol syntheses (Ferry *et al.*, 2015). The statistic result shows that nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution gives significant effect ($P < 0.05$) towards cholesterol level on the breast and thigh meat of the broiler. From the Duncan test is seen nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution (best on T5) is able to reduce better compared to *Melastoma malabathricum* L. fruit extract distribution towards cholesterol level of breast meat of the broiler. Cholesterol on the thigh meat shows that nano encapsulation of *Melastoma malabathricum* L. fruit extract distribution also gives better impact (best on T4) compared to *Melastoma malabathricum* L. fruit extract distribution towards thigh meat of the broiler. The distribution of *Melastoma malabathricum* L. fruit extract proves that it can reduce the cholesterol level inside broiler's meat. It is caused by the anthocyanin content from the *Melastoma malabathricum* L. fruit which is able to reduce the cholesterol level inside the body (Ferry *et al.*, 2015). It is supported by the research of Liang *et al.* (2013) which observed the impact of anthocyanin of blueberry towards mRNA HMG CoA Reductase towards hamster which was given additive feed 0.5 and 1% of anthocyanin from blueberry. The research result showed that the distribution of anthocyanin from blueberry is able to reduce the regulation of heart gene HMG CoA reductase.

Melastoma malabathricum L. fruit extract distribution apparently does not give any impact toward blood lipid profile of the broiler but is able to reduce the cholesterol of the broiler's meat. That is estimated caused by for fulfilling homeostatic inside the body. The distribution of *Melastoma malabathricum* L. fruit extract is able to reduce the body's ability to synthesizing cholesterol so that to fulfill it, the deposition of cholesterol inside the meat is lowering. This is in line with the research of Purwanti (2015) which researching the effectiveness of the use of photobiotic of turmeric extract and garlic as additive feed to increase the production performance of the broiler, one of which is the blood fat profile and meat's cholesterol. The result of that research showed that photobiotic distribution does not influence the blood lipid profile of the broiler but is able to reduce the cholesterol level inside the meat.

Conclusions

Based on the finding and discussion, it can be concluded that nano encapsulation of *Melastoma malabathricum* L. fruit extract is able to reduce the cholesterol level of the broiler's meat,

even though the reduction is not as much as those given simvastatin.

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