The Effect of Dosage and Method of Providing Cinnamononi Extract to Broiler’s Performance and Carcass’ Characteristic

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Abstract. This study was conducted to determine the effect of dosage and method of providing Cinnamononi Extract as feed additive to Broiler’s performance, and carcass’ characteristic. Cinnamononi Extract (CE) is an extract of cinnamon leaf, noni leaf, and noni fruit mixture at a ratio of 1:2:2. This experiment used a Complete Randomized Design (CRD) with 7 treatment combinations and 4 repetitions on 140 seven days aged chicks (strain AA). The treatment combinations were: T1= without CE and without fasting, T2= 250 mg CE/kg Body Weight and without fasting, T3= 350 mg CE/kg BW, without fasting, T4= 250 mg CE/kg BW after fasting for 1.5 hours in the morning, T5= 350 mg CE/kg BW after fasting for 1.5 hours in the morning, T6= 250 mg CE/kg BW after fasting for 1.5 hours in the day time, and T7=350 mg CE/kg BW after fasting for 1.5 hours in the day time. CE was given everyday by dissolving it in a limited water (± 5 ml/chicken). Results indicated that the combination of dosage and method of providing CE treatments increased (p < 0.05) broiler performance (it increased BWG, but reduced feed intake and FCR), but there was no significant effect (p > 0.05) on carcass characteristic. The conclusion of this experiment was that Cinnamononi Extract could be used as growth promotter feed additive. The effective and efficient dosage and method of providing Cinnamononi Extract to increase broiler performance is 250 mg/kg body weight after fasting for 1.5 hours either in the morning or in the day time.

1. Introduction
Broiler chickens are still a mainstay in fulfilling the needs of animal protein. However, the high fat content and the presence of antibiotic residues in the carcass can reduce consumers’ interest. Leeson and [1] stated that the growth of broiler chickens that are so fast will also followed by a high tendency to fat. Body fat of 6 weeks old broilers could reach 22.2% of body weight, while 2.86% of body fat comes from abdominal fat [2].

In maintenance of broiler chickens, the use of antibiotics can not be avoided, considering that broiler chickens are very susceptible to disease. Several types of antibiotics are also given in the ration as a growth promoter. The use of antibiotics in poultry rations will endanger consumers who eat these products through the residue left on the meat or egg [3] stated that penicillin is the most common residue founded in broilers’ liver, that is 41.3%.

Minister of Agriculture Regulation no. 14/2017 which is prohibited providing antibiotics in rations, urged feed producers and nutritionists to look for alternative replacements for antibiotic growth promotant (AGP). In this case, herbal plants can become an alternative replacement for antibiotics, due to the many and varied phytochemical contents and also efficacious as an anti-bacterial and can increase immunity. Ref. [4] extracted a mixture of cinnamon leaves, noni leaves, and noni fruit in various solvents to produce an extract called "Cinnamononi Extract" (CE) to replace the role of antibiotics. The result of [4] showed that Cinnamononi Extract obtained by maceration in water solvents produced the best anti-bacterial activity.
Besides having anti-bacterial ability, Cinnamononi Extract is thought to be able to promote the growth and production. It is because Cinnamononi Extract contains a proxeronine substance derived from noni fruit. Inside the body, proxeronine is converted to xeronine by the enzyme proxeroninase contained in it. Xeronine can activate the work of enzymes in the synthesis body protein [5].

Noni consumption techniques also affects the benefits of noni. According [6], consuming noni fruit when full will reduce the benefits of proxeronine and xeronine contained in noni fruit. This is because the pepsin and HCl contained in the stomach will damage the enzymes that are meant to free the xeronine. Therefore fasting treatment before providing Cinnamononi Extract is expected to optimize the work of the proxeroninase. However, fasting treatment causes chickens to lose the opportunity to eat, which is expected to decrease ration consumption. It is feared that declining consumption of rations will reduce growth rates. Therefore it is necessary to find the right time to do fasting.

Maintain broilers in the tropics area (as in Indonesia) causes chickens to heat stress, especially during the daytime. One of the responses of the chickens in overcoming this problem is to increase water consumption and stop eating when heat stress (during the day). Thus, fasting during the day may not affect the broiler’s ration consumption per day.

Based on the aforementioned description, it is necessary to do research to see the effect of dosage and administration techniques of Cinnamononi Extract on the effectiveness of Cinnamononi Extract as a growth promoter feed additive through performance response and broiler carcass quality.

2. Materials and Methods

This research used materials such as: fresh cinnamon leaves, fresh noni leaves and ripe noni fruit (yellow and still hard). The ration used consisted of the following ingredients: yellow corn, soybean meal, fish meal, top mix, and neobro. The composition of feed ingredients and nutritional content of the ration can be seen in Table 1.

The next materials were 140 seven-days-old broiler strain AA chicks, rice husk litter system cages which have been divided into 28 units (size: 80 cm x 80 cm x 80 cm per unit). Each unit consisted of 5 chicks. Each cage unit was equipped with one food container, drinking water container and a 60 watt incandescent lamp as a heater. The tools used in this research were: blenders, maceration tubes, analytical scales, ovens, and vacuum filters.

2.1. The Making of Cinnamononi Extract

Raw material preparation and Cinnamononi extract production were carried out by modifying the methods done by Ref. [7]. Cinnamon leaves, noni leaves and noni fruits were obtained from cinnamon and noni plants that grow around the Limau Manis Campus. The leaves and fruits were washed and drained, then sliced / cut to enlarge the surface area. The leaf and fruit slices were air dried for 2-5 hours, then put in an oven at 50°C for 24 to 50 hours. Then, these dried materials were milled and we got cinnamon leaf meal, noni leaf meal, and noni fruit meal. The process of making Cinnamononi Extract requires 1 part cinnamon leaf meal, 2 parts noni leaf meal and 2 parts noni fruit meal (1: 2: 2 ratio).

The making of Cinnamononi Extract was conducted by multilevel maceration and using water solvents. A mixture of 1 kg of raw material is put into 5 liters of warm water (1: 5 ratio), then soaked for 24 hours. After soaking for 24 hours, the mixture then filtered with filter cloth. The filtrate is called the first extraction filtrate. The residue from the filtering was soaked again with warm water and processed to the second extraction. The filtrate obtained from the two extractions was combined, then dried in an oven at 50°C to form a paste.

2.2. The Study of Providing Cinnamononi Extract to Broilers

Phytochemicals which expected as growth promotor in CE were proxeronine and xeronine contained in it. HCl content in the empty stomach is very limited. This helps proxeroninase to pass through the stomach. Therefore fasting before giving CE was expected to maximize the benefits of proxeronin. The chickens were fasted for 1.5 hours with the aim of giving a chance to the crop and proventriculus to empty themselves, so that HCl is not removed by the proventricular wall.

Experimental Design. This experiment used Complete Randomized Design [8], with 7 treatments and 4 repetitions. The treatments were a combination of dosage of providing Cinnamononi Extract with...
3 methods of providing (without preceded by fasting, preceded by fasting 1.5 hours in the morning, preceded by fasting 1.5 hours in the day time). The treatments were:

T1 = without CE and without fasting (ration is given ad libitum), T2 = Providing CE 250 mg/kg BW without fasting, T3 = Providing CE 350 mg/kg BW without fasting, T4 = Providing CE 250 mg/kg BW after morning fasting, T5 = Providing CE 350 mg/kg BW after day time fasting, and T7 = Providing CE 350 mg/kg BW after day time fasting. The treatment was given for 3 weeks starting with 8-days-old chicks.

CE was given through limited drinking water to be consumed (i.e. ± 5 ml / chick). 1.5 hours of fasting time in the morning was at 07.00 to 08.30 and in the afternoon was at 13.00 to 14.30. Rations would be given back again after half an hour from the moment of CE providence (0.5 hours of fasting after providing). This is to give proxeroninase a chance to pass through the stomach without being damaged by HCl.

Observations were made on these performance variables (feed consumption, body weight gain, and feed conversion ratio) and carcass characteristics (live weight, the carcass, and abdominal fat percentage). All data obtained were tested statistically by using analysis of variance (ANOVA) at 1% and 5%. Significant differences among treatment means were measured by Duncan Multiple Range test at p < 0.05 [8].

Table 1. Research ration formulation and content

| Feed ingredients | Starter Ration (%) Aged 0 – 2 weeks | Grover Ration (%) Aged 3 – 4 weeks |
|------------------|----------------------------------|----------------------------------|
| Corn flour       | 56                                | 54,7                              |
| Fine bran        | 0                                 | 5                                 |
| Fish flour       | 16                                | 9                                 |
| Soybean meal     | 24                                | 27                                |
| Vegetable oil    | 2,5                               | 3                                 |
| Bone flour       | 1                                 | 1                                 |
| Top mix/ Neobro* | 0,5                               | 0,5                               |
| Total            | 100                               | 100                               |

| Ration content   | Metabolizable energy (Kkal/kg)    | Rough protein (%)  |
|------------------|----------------------------------|--------------------|
|                  | 3073                             | 5.78               |
|                  | 23.307                           | 6.18               |
|                  | 3.39                             | 4.11               |
|                  | 1.246                            | 0.96               |
|                  | 0.667                            | 0.38               |

Note: * = top mix was used for conventional rations, and neobro was for antibiotic-free rations.

Conventional ration for T1 treatment was a ration prepared according to the formula above, using Top mix as feed supplement and feed additive. In the top mix there is bacitracin in the amount of 0.21%. Antibiotic-free rations for treatment T2 to T7 were prepared according to the ration formula above using neobro (which is free of antibiotics) as a feed supplement.
3. Result and Discussion

3.1. The Effect of dosage and Method of Providing Cinnamononi Extract to Performances

It should be noted in advance that this study was conducted on chickens that was suffered by hypernatremia (poisoned due to excess sodium). This happens because the fish meal used turns out to contain fairly high amount of NaCl, which is 9.6%. It was only discovered after the chickens were kept for two weeks, there were signs of excess salt, i.e. the feces was very wet, there was a decrease in consumption and increased mortality. Therefore an analysis of NaCl levels in fish meal was conducted and it turned out that the NaCl content in fish meal was quite high at 9.6%. In fact, this ration was formulated for the starter period (0 - 2 weeks) using 16% fish meal. Thus the total sodium intake by each chick was 1.2%, while the sodium requirement for chicks (starter period) is only 0.2%. As a result of this situation, the chicks experienced hypernatremia. Hypernatremia can cause edema, hypertension, and also cause the release of Ca from the bones resulting in bone loss and impaired absorption of Ca. If this situation continues then what will happen are kidney failure, rupture of blood vessels, nerve disorders, being unable to stand, tendons become very weak and convulsions before death, can even cause death [9]. After conducting an examination and observation of dead chickens, changes were found in various organs in the body, such as the enlarged heart and covered by liquid, enlarged kidneys, bleeding in various organs due to rupture of blood vessels, in the abdominal cavity there is a collection of fluid (ascites), liver and lungs enlarged due to fluid blockage (edema). The signs found are in accordance with the statement of [9] regarding the symptoms of salt poisoning. Mortality due to hypernatremia can be seen in Table 2.

Table 2. Death rate to 4 weeks

| Treatment                               | Weekly Death | Total of Mortality |
|-----------------------------------------|--------------|--------------------|
|                                         | II | III | IV |                |
| T1. Control (conventional ration)       | 1  | 1   | 9  | 11              |
| T2. CE 250 mg/kg BB without fasting     | 1  | 0   | 4  | 5               |
| T3. CE 350 mg/kg BB without fasting     | 2  | 2   | 3  | 7               |
| T4. CE 250 mg/kg BB after morning fasting | 2  | 2   | 3  | 7               |
| T5. CE 350 mg/kg BB after morning fasting | 1  | 0   | 5  | 6               |
| T6. CE 250 mg/kg BB after day time fasting | 2  | 2   | 2  | 6               |
| T7. CE 350 mg/kg BB after day time fasting | 1  | 0   | 5  | 6               |

Note: Morning fasting: start from 8.00 - 9.30, and day time fasting: start from 13.00 - 14.30. Different superscripts in the same column show significant difference (p < 0.05)

In Table 2, it can be seen that many deaths occur in the control treatment which was 11 chickens, whereas the death rate in the other six treatments was 6 chickens. This can show that Cinnamononi Extract can reduce the effect of hypernatremia in broiler chickens, thus death can be suppressed.

The response of broiler chickens to the combination of dosage treatment and method of providing of Cinnamononi Extract is presented in Table 3.
Table 3. The Effect of providing cinnamoni extract to broilers’ performances

| Treatment | Feed consumption (g/chicken/day) | Body Weight Gain | Feed Conversion Ratio |
|-----------|---------------------------------|-----------------|----------------------|
| T1. Control (conventional ration) | 51.87 a | 22.40 c | 2.32 a |
| T2. CE 250 mg/kg BW without fasting | 50.13 ab | 22.98 c | 2.18 a |
| T3. CE 350 mg/kg BW without fasting | 51.48 a | 22.73 c | 2.26 a |
| T4. CE 250 mg/kg BW after morning fasting | 47.39 b | 26.04 ab | 1.82 b |
| T5. CE 350 mg/kg BW after morning fasting | 47.36 b | 25.74 b | 1.83 b |
| T6. CE 250 mg/kg BW after day time fasting | 51.45 a | 28.17 a | 1.82 b |
| T7. CE 350 mg/kg BW after day time fasting | 50.10 ab | 27.12 ab | 1.84 b |
| SE | 1.023 | 0.75 | 0.066 |

Note: Morning fasting: start from 8.00 - 9.30, and day time fasting: start from 13.00 - 14.30. Different superscripts in the same column show significant difference (p < 0.05).

The analysis of variance showed that the dosage treatment and the method of providing CE significantly affected (p <0.05) to the rations consumption, weight gain, and rations conversion. After doing DMRT analysis it is known that the rations consumption at T1 is not significantly different (p > 0.05) with T2, T3, T6, and T7, but significantly different (p <0.05) with the consumption at T4 and T5, while the rations consumption at T4 was not significantly different (p > 0.05) from T5. It shows that the method of providing CE which was preceded by 1.5 hour fasting in the morning (T4 and T5) had an impact on decreasing feed consumption.

This was because the eating time in the morning has been reduced for 2 hours (1.5 hours of fasting before providing CE and 0.5 hours of fasting after providing), whereas, morning is an effective time for eating and digestion process. On the chickens that were given fasting treatment during the day (T6 and T7) it was seen that the feed consumption could match the feed consumption in the treatment T1 (control). This shows that fasting during the day does not reduce the eating time of broiler chicken. During the day in the Padang (tropical) ambient temperature is quite high, which ranges from 30° - 33°C, thus affecting the chickens’ body temperature and chickens will experience heat stress. One of the chicken's efforts to reduce the heat stress is to drink a lot and stop eating.

Weight gain can be a determinant study of broiler performance because livestock businesses always want a high weight gain from minimum consumption. In the analysis of variance, it was seen that the dose and time of providing CE significantly affected (p<0.05) to the body weight gain (BWG). After DMRT analysis, it was found that chickens were given treatment T1 gave a BWG response that was not significantly different (p>0.05) with treatment T2 and T3, but BWG at treatment T1 was significantly lower (p<0.05) than T4, T5, T6, and T7. DMRT analysis results also showed that BWG in treatment T4 and T5 was not significantly different (p>0.05) with treatment T7, while T4 was not significantly different (p>0.05) from T6, and treatment 7T6 was not significantly different (p>0.05) from T7.

The result of this study indicates that the providing of CE without preceding fasting (T2 and T3) does not have an impact on increasing BWG. This is because providing CE without fasting can causes the proxeroninase enzyme to be damaged by the presence of HCl and pepsin in proventriculus, so that the enzyme cannot change proxeronine in cinnamoni extract, which is derived from noni fruit, into xeronine. As it is known that substances that play role in increasing protein metabolism and repairing damaged cells are xeronine not proxeronine. As stated by [3] that, if consuming proxeronine contained
in noni fruit in an empty stomach, the enzyme proxeroninase it contains will convert proxeronine to xeronine in the small intestine. Xeronine that is absorbed into cells can activate enzymes involved in protein metabolism.

In treatment T4, T5, T6, and T7, where chickens are fasted 1.5 hours in the morning or afternoon before providing the Cinnamononi Extracts, it gave a BWG response higher than treatment T1 (control). This showed that providing CE after 1.5 hour fasting was able to increase the chickens’ BWG. Fasting causes an empty stomach, so HCl and pepsin are not secreted into the proventriculus lumen, thus the enzyme proxeroninase contained in CE is not denatured as it passes through proventriculus, so it can escape to the small intestine.

In the small intestine, proxeroninase activates proxeronin to xeronin. This Xeronin will play a role in promote growth [3]; [1]. DMRT analysis result also shows that morning fasting before providing CE (T4 and T5) gives BWG that is relatively the same as of daytime fasting does (T6 and T7). Thus the impact is no decrease in consumption.

Non significant difference in BWG (p> 0.05) between treatment T2 and T3, T4 and T5, and T6 and T7, shows that BWG of chicken that given CE dose of 250 mg / kg BW is not significantly different from BWG of chicken that given a dose of 350 mg / kb BW. In other words, increasing the dose of CE from 250 mg / kg BW to 350 mg / kg BW does not increase BWG. Thus an efficient dose of Cinnamononi Extract for broiler chickens is 250 mg / kg BW.

Measuring by DMRT on feed conversion data showed that the treatment T1 was significantly different (p<0.05) with T4, T5, T6, and T7, but not significantly different (p> 0.05) with T2 and T3. The result of this study indicates that the providing of CE which was preceded by fasting for 1.5 hours gives a better FC value than providing without fasting. It is because fasting before providing Cinnamononi Extract gives the proxeroninase enzyme a chance to pass through proventriculus without being denatured, so that the enzyme can convert proxeronine to xeronine in the small intestine. Xeronine which is absorbed will stimulate protein metabolism and replace damaged cells, so that the weight gain can increase.

The results of this study also showed that providing CE which was preceded by 1.5 hour fasting in the morning (T4 and T5) obtained value of feed conversion that is not significantly different (p> 0.05) then those given 1.5 hour fasting treatment during the day time (T6 and T7). This showed that the providing of Cinnamononi Extract which was preceded by fasting in the morning and day time gives a relatively equal feed conversion.

3.2. The Effect of Dosage and Method of Providing CE to Carcass’ Characteristic
Carcass’ characteristic can be seen from parameter of live weight, carcass percentage, and abdominal fat percentage. These data are presented in Table 4.
Table 4. The effect of cinnamononi extract to broiler’s live weight and carcass’ characteristic when harvested at 4 weeks

| Treatment                                  | Live weight (g/bird) | Carcass percentage (%) | Abdominal fat percentage (%) |
|--------------------------------------------|----------------------|------------------------|-----------------------------|
| T1. Control (conventional ration)          | 619.50<sup>c</sup>   | 64.25                  | 0.761                       |
| T2. CE 250 mg/kg BW without fasting        | 677.00<sup>bc</sup>  | 63.49                  | 0.632                       |
| T3. CE 350 mg/kg BW without fasting        | 756.50<sup>bc</sup>  | 65.26                  | 0.942                       |
| T4. CE 250 mg/kg BW after morning fasting  | 979.75<sup>a</sup>   | 67.20                  | 1.390                       |
| T5. CE 350 mg/kg BW after morning fasting  | 843.00<sup>ab</sup>  | 67.22                  | 1.255                       |
| T6. CE 250 mg/kg BW after day time fasting | 846.25<sup>ab</sup>  | 67.17                  | 1.792                       |
| T7. CE 350 mg/kg BW after day time fasting | 838.00<sup>ab</sup>  | 65.72                  | 0.783                       |
| SE                                         | 45.76                | 0.317                  | 0.317                       |

Note: Morning fasting: start from 8.00 - 9.30, and day time fasting: start from 13.00 - 14.30. Different superscripts in the same column show significant difference (p < 0.05)

Analysis of variance showed that the treatment had a significant effect (p <0.05) on live weight, but had no significant effect on the percentage of carcasses and abdominal fat. Measuring by DMRT on live weight data showed that the treatment T2 and T3 gave a live weight response that is not significantly different (P> 0.05) to the control ration (T1). Meanwhile T4, T5, T6 and T7 produced live weight that is significantly higher (P <0.05) than treatment T1. Measuring by DMRT also showed that there were not significantly different (P> 0.05) among treatments T4, T5, T6 and T7 in live weight response.

This showed that the treatment of fasting before providing CE can increase life weight. Fasting causes the stomach to be empty, so that HCl and pepsin are not much contained in the stomach. Thus providing CE after fasting will neglect the enzyme proxeroninase through the stomach into the small intestine. In the small intestine, proxeroninase will convert proxeronine to be xeronine. Xeronin that is absorbed will improve and increase protein metabolism, so the growth increases.

4. Conclusion

From the data obtained in this study, it can be concluded that Cinnamononi Extract (CE) can act as a feed additive to promote the growth of broiler chickens. The dosage of Cinnamononi Extract that is effective and efficient in improving the performance of broiler chickens is 250 mg / kg BW which is provided after fasting 1.5 hours either in the morning or in the day time.

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