Effect of addition garlic flour as feed additive in digesta viscosity, microflora, and intestinal characteristic of native chicken crossbred

Sjofjan O¹, Irfan H D¹, Halim M H¹, Hanitawati², and Teguh H²

¹Lecturer of Animal Nutrition Department, Animal Science Faculty, Brawijaya University
²Student of Animal Science Faculty, Brawijaya University
E-mail: osofjan@yahoo.com

Abstract. The research purpose was to determine the garlic flour effect as the feed additive on digesta viscosity, microflora, and intestinal characteristic of broiler. The research method was used completely randomized design with 5 treatments and 5 replicates. The materials used for this research were 300 unsex day old chicks with native chicken crossbreed strain with average body weight 40.11±9.13 g/head. The treatments used for research were dietary with T0 (basal feed), T1 (basal feed + 0.25% garlic flour), T2 (basal feed + 0.30% garlic flour), T3 (basal feed + 0.35% garlic flour), T4 (basal feed + 0.40% garlic flour). The parameters observed were digesta viscosity, intestinal characteristic bacteria (lactic acid bacteria, Escherichia coli, and Salmonella sp.), and (villus length, crypt depth, and villus surface). The data analysis was the analysis of variance (Anova) and continued by Duncan Multiple Range Test. The results showed that using the garlic flour effect as feed additive has significant difference (P<0.05) on viscosity digesta, intestinal characteristic (crypt depth and villus surface) (Salmonella sp.) and significantly different (P<0.01) (Lactic acid bacteria and Escherichia coli). The addition of 0.45% garlic flour gave the best effect on digesta viscosity, microflora, and intestinal characteristic of native chicken.

Keywords – garlic, microflora, intestinal characteristic, villus, native chicken crossbred.

1. Introduction

Sources of protein can be obtained from livestock products e.g. meat. There are several commodities that produce meat product e.g. chicken, cattle, and goat. However, chickens are given biggest sources of protein resources from white meat products. The quality of native chicken carcass mostly from several factors. The feed is the effect to the quality of native chicken. The using feed additive is one method to improve the quality of feed. The native chicken has lower fat content than broiler. The productivity of native chicken crossbred is low due to the extensive method rearing. The antibiotics are given as growth promoter but antibiotics cause bacterial resistance and residue in the carcass [1].

Nowadays, feed additive use as substitute from antibiotics due it’s safer. The used of feed additive can increase the absorption nutrient in the native chicken that will affect the internal organs. The indicator performance (feed intake, body weight, feed conversion ratio, mortality, and production index) and enzyme activities (protease and amylase), intestinal characteristic (villus total and villus height) [2]. Garlic can be used as feed additive to optimizing the absorption. The garlic flour as feed additive producing the allicin and diallyl sulfide that can inhibit microbial pathogen growth.
Probiotics, prebiotics, and medicinal plants as natural feed additives are currently used in poultry diets to enhance the intestinal characteristics and immune response of chickens [3]. According to the [4] stated the garlic (*Allium sativum*) has bioactive components like sulfur containing compounds (Allin, Diallysulfides, and Allicin) that act as antibacterial, antifungal, anti-parasite, antiviral, antioxidant, antithrombotic, ant cancerous, and vasodilator characteristics. Garlic has several beneficial effects on chickens having antimicrobial, antioxidant as well as antihypertensive properties. These functions were attributed to bioactive components [4].

2. Materials and methods
2.1. Materials

The principal equipment for the research are litter with 100x100x70 cm, brooder, hygrometer, thermometer, analytic scale, the postal cage with closed house, feed bunk, and drink bunk. The principal materials are 300 unsex day old chicks with native chicken crossbred strain with average body weight 40.11±9.13 g/head produced by local breeder in Blitar, East Java Province.

2.2. Methods

The research method was used completely randomized design with 5 treatments and 5 replicates. The replicates consist 12 heads of native chicken crossbred with total (300heads). The level of dietary and garlic flour were:

- **T₀** = (basal feed)
- **T₁** = (basal feed + 0.25% garlic flour)
- **T₂** = (basal feed + 0.30% garlic flour)
- **T₃** = (basal feed + 0.35% garlic flour)
- **T₄** = (basal feed + 0.40% garlic flour)

2.3. Variables

The variables observed were digesta viscosity, intestinal characteristic bacteria (lactic acid bacteria, *Escherichia coli*, and *Salmonella* sp.), and (villus length, crypt depth, and villus surface).

2.4. Data Analysis

The data analysis using analysis of variance (Anova) and continued by Duncan’s Multiple Range Test [5].

3. Results and discussion

3.1. The garlic flour in the digesta viscosity and intestinal characteristic bacteria

| CODE | Digesta viscosity* | Villus length* | Crypt depth** (µm) | Villus surface** (µm) |
|------|-------------------|----------------|---------------------|-----------------------|
| **T₀** | 10.78±0.35<sup>a</sup> | 485.71±92.46<sup>b</sup> | 140.87±17.42<sup>b</sup> | 759.11±95.75<sup>b</sup> |
| **T₁** | 11.23±0.4<sup>a</sup> | 381.60±49.59<sup>a</sup> | 148.46±8.57<sup>b</sup> | 630.52±119.44<sup>b</sup> |
| **T₂** | 10.48±1.64<sup>a</sup> | 453.77±27.40<sup>ab</sup> | 142.50±17.6<sup>b</sup> | 787.05±53.23<sup>b</sup> |
| **T₃** | 17.64±2.21<sup>c</sup> | 406.96±35.19<sup>ab</sup> | 121.96±11.63<sup>a</sup> | 794.50±32.14<sup>b</sup> |
| **T₄** | 14.45±4.48<sup>b</sup> | 532.02±93.24<sup>ab</sup> | 148.02±9.23<sup>b</sup> | 1073.49±99.92<sup>c</sup> |

**Superscript showed significantly different (0.01).**

*Superscript showed significant different (0.05).
3.1.1. The garlic flour effect in digesta viscosity

Based on table 1 result from the research on the digesta viscosity activities showing the T1 higher are (17.64±2.21) with (basal feed + 0.35% garlic flour) and lower T0 are (10.78±0.35) (basal feed). The treatment from lower to higher is T0, T2 T1, and T3. The average viscosity digesta are significant different (P<0.05). The used garlic flour is impacted to the viscosity digesta.

The viscosity digesta are fluidal system in the intestinal that compared between the gradient of the digestive tract. The higher of the viscosity digesta has negative effect to the efficiency digestive tract due to slowly the endogenous enzyme diffusion that react with the substrate and nutrient in intestinal wall [6]. There are several factors that affect to the digesta viscosity e.g. pH [7]. According to [8] stated if the viscosity of digesta higher the native chicken is one product which has a high nutritional value that can be accepted while public awareness of the native chicken which is a conventional food and medicine due to its bioactive components form of functional food which able to prevent the disease. That depressed absorption of nutrients, including amino acids are more common such as this might cause by an increase in digesta viscosity and a reduction in the movement of nutrients through a dense of unstirred water layer rather than changes in the transport capacity of the mucosal membranes [9].

3.1.2. The garlic flour effect in villus length

Based on table 1 result from the research on the villus length showing the T4 higher are (532.02±93.24) with (basal feed + 0.40% garlic flour) and lower T1 are (406.96±35.19) (basal feed + 0.25% garlic flour). The treatment from lower to higher is T1, T3 T2, and T4. The average villus length are significant different (P<0.05). The used garlic flour is impacted to the villus length due to the level of garlic given.

The villus size are fluidal system in the intestinal that compared between the gradient of the digestive tract. Stated the higher of the viscosity digesta has negative effect to the efficiency digestive tract due to slowly the endogenous enzyme diffusion that react with the substrate and nutrient in intestinal wall [6]. There are several factors that affect to the digesta viscosity e.g. pH. The garlic flour is affect to the variable due to bioactive compound that inhibit and decreasing the microbial pathogen that villus growth are optimum. The bioactive compound is allicin that decreasing the Aspergillus flavus and Aspergillus parasiticus.

3.1.3. The garlic flour effect in crypt depth

Based on table 1 result from the research on the villus length showing the T1 higher are (148.46±8.57) with (basal feed + 0.25% garlic flour) and lower T3 are (121.96±11.63) (basal feed + 0.35% garlic flour). The treatment from lower to higher is T1, T3 T2, and T1. The average crypt depth are significant different (P<0.05). The used garlic flour is impacted to the crypt depth due to the level of garlic flour given.

The garlic flour affected increased due to the bioactive compounds that consists and synergetic with basal feed. That the garlic flour stimulate the growth of the native chicken, increasing the optimizing of internal organ, that affecting to the nutrient absorbing in other wise, has function balancing the antibody and immune system of chicken [4]. The garlic flour affected to the consistency of the feed increase in otherwise the garlic has hygroscopic ability to absorb the water content.

3.1.4. The garlic flour effect in villus surface

Based on table 1 result from the research on the villus length showing the T4 higher are (1073.49±99.92) with (basal feed + 0.40% garlic flour) and lower T1 are (630.52±119.44) (basal feed + 0.25% garlic flour). The treatment from lower to higher is T1, T0, T2 T3, and T4. The average villus surface are significant different (P<0.05). The used garlic flour is impacted to the villus surface due to the level of garlic flour given. That villus surface are depend on the several factors e.g. environment, feed, bioactive compounds [10]. The increasing of villus surface are indirect with the flour but by bioactive compounds from garlic.
3.2. The garlic flour in the digesta viscosity and intestinal characteristic bacteria

Table 2. The garlic flour effect in Lactic acid bacteria, E. coli, and Salmonella sp.

| CODE | Lactic acid bacteria** | Escherichia coli** (log CFU/g) | Salmonella sp.* |
|------|------------------------|---------------------------------|-----------------|
| T₀   | 8.33±0.50<sup>ab</sup>  | 4.44±0.61<sup>a</sup>          | 5.29±0.36<sup>ab</sup> |
| T₁   | 9.05±0.96<sup>b</sup>   | 4.07±0.54<sup>a</sup>          | 4.52±1.29<sup>ab</sup> |
| T₂   | 8.95±0.39<sup>b</sup>   | 5.46±0.45<sup>b</sup>          | 6.51±0.95<sup>b</sup> |
| T₃   | 7.68±0.17<sup>a</sup>   | 4.42±0.32<sup>a</sup>          | 4.29±1.08<sup>a</sup> |
| T₄   | 8.92±0.67<sup>b</sup>   | 4.12±0.33<sup>a</sup>          | 5.17±0.32<sup>ab</sup> |

** Superscript showed significantly different (0.01).
* Superscript showed significant different (0.05).

3.2.1. The garlic flour effect in Lactic acid bacteria, E. coli, and Salmonella sp.

Based on table 2 result from the research on the villus length showing the T₁ higher are (9.05±0.96<sup>b</sup>) with (basal feed + 0.25% garlic flour) and lower T₃ are (7.68±0.17) (basal feed + 0.35% garlic flour). The treatment from lower to higher is T₁, T₂, T₄, T₀, and T₃ The average villus surface are significantly different (P<0.01). The used garlic flour is impacted to the lactic acid bacteria due to the level of garlic flour given. That intestinal villus have a correlation with the capacity to absorb the chicken diet, the longer and wider the intestinal villus the more efficient nutrient absorption process [10].

The active substances in garlic increase the Lactobacillus sp bacteria to decrease the number of the Escherichia coli with the lowest are T₀ are (4.12±0.33) and Salmonella sp T₃ are (4.29±1.08) in the intestinal native chicken. However, the garlic flour is relatively useful in maintaining the balancing between non-pathogenic and pathogenic bacteria. The garlic powder has antibacterial properties due to the greater presence of an active substance. The key of succeeded chicken performance are depend on the number bacteria pathogenic and non-pathogenic in gut [11].

4. Conclusions

The addition garlic flour gave the best effect on digesta viscosity, microflora, and intestinal characteristic of native chicken. There was no negative effect on the characteristics of small intestine and the number of lactic acid bacteria, Escherichia coli, and Salmonella sp.

5. References

[1] Sjofjan, O. 2003. Kajian probiotik (Aspergillus niger dan Bacillus spp) sebagai imbuhan Pakan dan implikasi efeknya terhadap mikroflora usus serta penampilan produksi ayam petelur. Disertasi. Universitas Padjajaran. Bandung.

[2] Sjofjan, O., M. H. Natsir, dan T. Ardianti. 2015. Efek penggunaan probiotik kultur campuran dalam air minum terhadap karakteristik dan mikroflora usus ayam petelur. J. Ilmiah Bio. 1: 52-58.

[3] Sjofjan, O., E. Widodo, and V.A. Soffa. 2012. Pengaruh penggunaan fitobiotik dalam bentuk tanpa dan terenkapsulasi sebagai aditif pakan terhadap aktivitas enzim usus ayam pedaging. JIIP.

[4] Dharmawati, S., N. Firahmi, dan Parwanto. 2013. Penambahan tepung bawang putih (Allium sativum L) sebagai feed additive dalam ransum terhadap penampilan ayam pedaging. J. Ziraah. 38 (3): 5-12.

[5] Steel, R.G.D. dan J.H. Torrie. 1992. Prinsip dan prosedur statistika. PT. Gramedia Jakarta.

[6] Natsir, M. H., E. Widodo dan Muharli. 2016. Penggunaan Kombinasi Tepung Kunyit (Curcuma domestica) dan Jahe (Zingiber officinale) Bentuk Enkapsulasi dan Tanpa
Enkapsulasi Terhadap Karakteristik dan Mikroflora Usus Ayam Pedaging. Buletin Peternakan. 40 (1): 1-10.

[7] Sjofjan, O., M. H. Natsir, dan D. Y. Primacitra. 2014 Pengaruh Penambahan Probiotik (Lactobacillus sp) dalam pakan terhadap energi metabolis, kecernaan protein, dan aktivitas enzim burung puyuh. J. Ternak Tropika. 15 (1): 74-79.

[8] Jein, R. L., Achmanu, O. Sjofjan, and M. Najoan. 2013. Egg Internal Quality and n-3 fatty acids of native chicken fed on skipjack fish (Katsuwonus pelamis l) industrial waste containing feed. Int. Poul. Sci. 12 (8): 484-488.

[9] Jet, S. M., H. Soetanto, O. Sjofjan, and B. Tulung. 2013. The effect of native gedi leaves (Abelmoschus manihot L. Medik) of northern Sulawesi-Indonesia as a source of feedstuff on the performance of broilers. Int. J. Biosci. 3 (1): 82-91.

[10] Mozin, S., D. Rosyidi, O. Sjofjan, and E. Widodo. 2015. The effect of shallot (Allium ascalonicum L.) by-product as an antibacterial and alternative phytobotic on characteristics of small intestine of broiler. Livestock. Rsch. for rural dev. 27 (4): 1-8.

[11] Septiani, A., O. Sjofjan, and Irfan H. Djunaidi. 2016. Effect of some kinds of commercial feed on quantitative and qualitative production performance of broiler chicken. Buletin peternakan. 40 (3): 187-196.