Addition of Aloe vera powder (Aloe barbadensis Miller) with different levels to digestive tract length and the digestion rate of broiler

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Abstrak. Broiler chicken is a type of chicken that has a fast growth rate and requires large amounts of nutrients absorbed from feed. Absorption of nutrients in the feed requires the function of a good digestive tract to optimize the digestive process. The digestive process also requires optimal time in absorption of feed nutrients called the digesta rate. The purpose of this study was to determine the right level of addition aloe vera powder to the length of digestive tract and the rate of broiler digestion. This study used a completely randomized design with 4 treatments and 4 replications, namely P0: feed without aloe vera powder (control), P1: feed + 0.075% aloe vera powder, P2: feed + 0.1% aloe vera powder and P3: feed + 0.125% aloe vera powder. The treatment had a significant effect on the jejunum length and digestion rate, but it had no significant effect on the duodenum length and the ileum length. The jejunum length was significantly different in treatment P1 (85.50 cm) and P3 (83.75 cm) compared to treatment P0 (73.25 cm). Digestion rate of broilers was significantly different from the P3 treatment compared to the control treatment. The results of the study showed that the addition of aloe vera powder with the best level was 0.125% (P3) which optimizes the jejunum length and the rate of digesta broiler.

1. Introduction

Broiler chicken as a food source of protein was so attractive to the public because the price was quite affordable [1]. In addition, broilers were among the types of chickens that have a fast growth rate and require large amounts of nutrients to be absorbed from the feed. One of the things done on the maintenance of broiler chickens was by providing feed additives as a growth booster, increasing production efficiency and as a deterrent to disease. Addition of feed additives can be given through the use of natural herbal plants using bioactive substances contained in these plants. The absorption of nutrients in the feed requires good digestive tract function in order to optimize the digestive process. Good digestion can be described by the normal size of the digestive organs of livestock. If the feed given can be digested properly then the digestive organs will not be disturbed so that the absorption process of feed nutrients occurs optimally. The digestion process also requires optimal time in the absorption of feed nutrients called the digesta rate. The increased digestion process will slow down the rate of digesta to maximize the absorption of feed nutrients in the digestive tract. Aloe vera (Aloe Barbadensis Miller)
was a plant that has been widely used for health [2]. This plant has a lot of bioactive substances that can stimulate metabolism which is likely to be used as a supplement to natural food. The role of aloe vera in the digestive tract was known to increase intestinal mucosal cells so that it can increase the absorption of nutrients in the intestine and optimize the development of digestive tract organs.

Aloe vera powder (Aloe Barbadensis Miller) was thought to increase the length of the digestive tract through the content of bioactive substances contained therein. In addition, it was expected to optimize the digesta rate process. But it is not yet known at what level of aloe vera powder that is right to give to broilers. This study aimed to determine the administration of aloe vera powder (Aloe Barbadensis Miller) with different levels of digestive tract length and digestion rate. The usefulness of the research was expected to be a source of information to the public, especially breeders, in the use of Aloe vera powder as feed supplement of broiler chickens.

2. Materials and methods
The study was conducted from March to May 2019. Aloe vera powder was made in the Integrated Laboratory of the Faculty of Animal Husbandry, Hasanuddin University, preparation of rations and mixing of feed in the Laboratory of Non-Ruminant Poultry Rations, Faculty of Animal Husbandry, Hasanuddin University, raising chickens in Poultry Laboratory Experiments Cages, Faculty of Animal Husbandry, Hasanuddin University. The enclosure used is a postal enclosure (litter system), in which plots of 100 x 100 x 50 cm (length x width x height) are made in 16 plots. Litter is derived from rice husks sown in cages with a thickness of ± 5 cm.

This research used 80 day old unsexed Cobb chicks and maintained for 42 days. This study consisted of 16 experimental units. The maintenance phase was divided into two, namely the starter phase aged 1-14 days and the finisher phase aged 15-42 days. Each plot was filled with 5 chickens, and used incandescent lamps (60 watts) as heaters instead of broodstock. The feed given was ration which has been mixed with aloe vera powder. The composition of the preparation of feed requirements for starter and finisher phases was based on the National Research Council [3] and Indonesian National Standards [4]. Drinking water provided ad libitum.

The experimental design carried out in this study was a completely randomized design with 4 treatments and 4 replications. Each unit consisted of 5 chicks as sub unit in the experiments. The composition of the treatment consists of 4 types of feed, namely: P0 = feeds without aloe vera powder (control), P1 = feeds with aloe vera powder 0.075%, P2 = feed with aloe vera powder 0.1%, P3 = feed with aloe vera powder 0.125%.

The analysis of variance was performed to determine the effect of treatment on the measured parameters. If it has significant effect, it is continued with Duncan's test [5].

3. Results and discussion
The results of research on aloe vera powder (Aloe barbadensis Miller) with different levels of digestive tract length and digesta rate are presented in table 1.

3.1. Length of the digestive tract
The results of variance showed that the administration of aloevera powder had no significant effect (P>0.05) on the length of the duodenum and the length of the ileum. This is due to the fact that the duodenum only functions as a breakdown of food substances to be continued in the jejunum where maximum absorption occurs, so the role of aloe vera as an antibacterial and increases the absorption of nutrients, does not work directly on the duodenum. In addition, the duodenum was the shortest digestive tract which causes the ration time to pass through the duodenum to be quite short. This was in accordance with the opinion of Yuwanta [6] that duodenum was the first part of the small intestine which has the function of absorption of water, sodium and other minerals. Duodenal wall secretes enzymes that can increase the pH of food substances in the duodenum, so that solubility and absorption in the jejunum will increase.
Table 1. Length of digestive tract and digestion rate of 42 day broiler chickens.

| Parameters          | Treatment |
|---------------------|-----------|
|                     | P0       | P1       | P2       | P3       |
| Length of duodenum (cm) | 31.25 ± 2.63 | 30.50 ± 1.73 | 31.00 ± 1.41 | 31.50 ± 2.38 |
| Jejunum length (cm)  | 73.25 ± 6.89<sup>a</sup> | 85.50 ± 6.75<sup>c</sup> | 76.00 ± 3.91<sup>ab</sup> | 83.75 ± 5.18<sup>bc</sup> |
| Ileum length (cm)    | 70.25 ± 4.78 | 83.00 ± 6.16 | 74.75 ± 4.03 | 82.00 ± 14.87 |
| Digesta rate (minutes) | 200 ± 9.57  | 214 ± 31.59<sup>a</sup> | 213 ± 26.76<sup>a</sup> | 259 ± 6.13<sup>b</sup> |

<sup>abc</sup>Superscript in the same line shows a real difference (P <0.05). P0: Feed without aloevera powder (control), P1: Feed + aloevera powder 0.075%; P2: Feed + aloevera powder 0.1%; P3: Feed + aloevera powder 0.125%.

The length of the ileum did not affected by the administration of aloe vera powder because this section is only a place for absorption of bile salts and vitamins, so the role of aloe vera powder does not work in the ileum region. This is in accordance with the opinion of Adriani, et al [7] who stated that ileum contains receptors to absorb vitamin B12 and bile salts. In addition, ileum works as a place of absorption of food substances that were still left from previous digestion, so ileum only continues to absorb the remaining food substances that have not been absorbed. This was in accordance with the opinion of Hazelwood [8] that ileum functions as a place of absorption of nutrients namely amino acids, vitamins and monosaccharides into the blood circulation.

There were other factors that can affect the growth and development of the duodenum and ileum, including the environment and food that enters the digestive tract which causes a long developmental response to the duodenum and ileum. Usman [9] stated that the factors that influence the development of the small intestine were the age of the animal, the type of livestock, the environment and the ration consumed.

The results of variance showed that the administration of aloe vera powder affect significantly (P <0.05) the length of the jejunum. The control treatment (P0) was different from treatment P1 and P3 but not different from treatment P2. The treatment of P1 was different from P2 but not different from P3. Whereas P2 treatment was different from treatment P1 and P3. This was likely due to differences in the amount of bioactive substances contained in aloe vera such as saponins and anthraquinons. These substances which help spur the development of the digestive tract and were known to have antibacterial properties that suppress the growth of pathogenic bacteria that can interfere with the absorption of nutrients. This was in accordance with the opinion of Onning et al [10] that aloe vera contains saponins and anthraquinons which were beneficial to the body. Saponin in low concentrations can increase the permeability of intestinal mucosal cells, thus increasing absorption of nutrients in the intestine.

In addition, jejunum including the longest part of the small intestine, because it has a function of almost 90% absorption of nutrients from digested food was also referred to as the main part of absorption of nutrients. So that the content of aloe vera powder was absorbed and works optimally in the jejunum. This was in accordance with the opinion of Amrullah [11] that the process of enzymatic digestion and absorption occurs in the jejunum most. The difference in the length of jejunum in each treatment was influenced by other factors, one of which was the consumption of ration. In the P2 treatment, the lowest value was caused by the relatively low consumption of rations, which was 2356.7 g/b so that the lack of small intestinal activity in digest the ration caused the development of jejunum length not optimal. Whereas the P3 treatment showed the highest value due to the increased consumption of rations, which was 2808.4 g /head, which spurred the development of jejunum length.

The average length of duodenum, jejunum and ileum obtained is still in the normal range. The length of the duodenum was 31.25 - 31.50 cm, the length of the jejunum ranges from 73.25 - 85.50 cm while the length of the ileum was 70.25 - 83.00 cm. This is consistent with the opinion of Achmanu and Muharlien [12] who stated that the normal length of duodenum in broiler chickens ranges from 30 cm while the length of normal jejunum ranges between 68-120 cm, and Putnam [13] that the length of ileum in healthy broilers reaches more than 70 cm.
3.2. Digestion rate

The results of variance showed that the administration of aloe vera powder had a significant effect (P < 0.05) on the digestion rate of broilers. The P0 treatment was different from the P3 treatment but were similar to the P1 and P2 treatments. The P1 treatment was different from the P3 treatment but not different from the P2 treatment. While the P3 treatment was significantly different from the other treatments, namely the digesta rate for 259 minutes or 4 hours 31 minutes.

This was due to the influence of aloe vera powder content, namely saponins and antrakinons that work in the digestive tract, especially in the small intestine. Although the mechanism of action of aloe vera powder did not play a direct role in the rate of digesta, it was closely related to normal small bowel development. Causing the digestion rate in the digestive tract to occur maximally. The longer the size of the small intestine, the more optimal absorption of nutrients, the more optimal absorption of nutrients, the digesta process takes place longer.

The results of the average rate of digesta broiler obtained in this study ranged from 200-259 minutes or 3-4 hours. These results indicate that the digesta rate obtained was still in accordance with the normal time in broiler chickens and does not exceed the tolerance limit of the digesta rate or exceed 5 hours. This is in accordance with the opinion of Agus [14] that the length of feed in the digestive tract of poultry lasts approximately 4 hours.

The difference in digesta rate at each treatment is due to other factors that affect the digesta rate, including the difference in fiber consumption in each treatment. Digesta rate at P2 treatment shows a short time due to low fiber consumption in the treatment, which is an average of 6.61 g / head / day. While the digesta P3 treatment rate showed the longest time due to the relatively higher fiber consumption than other treatments with an average of 8.87 g / head / day. This was in accordance with the opinion of Amrullah [11] that crude fiber has the benefit of helping the intestinal peristalsis, preventing rationing of rations, affecting the rate of digesta. Crude fiber that was not digested will bring other nutrients out with feces and consequently will accelerate the digesta rate. Thus, in the use of high crude fiber will also have a negative effect on nutrient absorption. There is a maximum limit on the use of crude fiber in broilers, according to BSNI [4] the need for feed fiber in broilers is a maximum of 6%.

4. Conclusion

The addition of aloe vera powder with a level of 0.125% in broiler feed can optimize the length of the jejunum and increase the rate of digestion in the digestive tract of broilers.

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