The influence of *Phyllanthus niruri* L. powder and Zn-bacitracin antibiotics on the relative weight of carcasses and intestines of broiler

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Abstract. *Phyllanthus niruri* L (meniran) is included in Euphorbiaceae which is easy to grow in various geographies and has active compounds such as terpenoids, alkaloids, flavonoids, saponins, tannins, and phyllanthin. The purpose of this study was to evaluate the administration of *Phyllanthus niruri* L powder to the relative carcass weight, upper thighs, lower thighs, back, breast, wings and weights and the relative length of the intestine, duodenum, jejunum, and ileum of broiler chickens. The study used a Completely Randomized Design with 5 treatments, 4 replications, each replication consisted of 10 DOC with the following treatments: T1 (without antibiotics and *P. niruri* L powder (Control); T2 (Zn-bacitracin 0.05%); T3 (*Phylanthus niruri* L. powder 0.0157%); T4 (*Phylanthus niruri* L. powder 0.0313%); T5 (*Phylanthus niruri* L. powder 0.0470%). The results showed that life weight and relative weight of carcass, back, breast, upper thighs, lower thighs, wings, head + neck, legs, and abdominal fat were not significantly different (P>0.05) between treatments T1, T2, T3, T4, and T5. But the real breast relative weight (P<0.05) was higher in the T5 treatment compared to T2, T3, and T4. Likewise, the relative weight and length of the small intestine, duodenum, jejunum, and ileum were not significant (P>0.05) between all treatments. It was concluded that the treatment of *P. niruri* L. powder up to 0.0470% was not significant with the Zn-bacitracin treatment on live weight and relative weight of carcass, back, breast, upper thighs, lower thighs, wings, back, hackle + neck, legs, and abdominal fat. Also the relative weight and length of the small intestine, duodenum, jejunum, and ileum. Except for the *P. niruri* L. powder 0.0470% treatment that the relative weight of the breast was significantly higher than the Zn-bacitracin treatment, *P. niruri* L. powder 0.0157% and 0.0131%.

1. Introduction
Increasing *Phyllanthus niruri* L (meniran) is included in the Euphorbiaceae family and is a wild herb that is easy to grow in various geographies. It is estimated that there are more than 600 *Phyllanthus* species, that one of them is *Phyllanthus niruri* L. [1–3]. *P. niruri* L can be found in amazon and tropical areas and anywhere with moderate temperatures such as Indonesia [4–6]. Its has active compounds, including the terpenoids, alkaloids, flavonoids, saponins, and tannins, and the dominant one is filantin [7–11]. The active compound *P. niruri* L has antimicrobial properties, can cure digestive tract disorders and diarrhea [12–15]. At a concentration of 60%, *P. niruri* L could minimize the growth of *S. dysenteriae*
bacteria and even eliminate these bacteria which were tested in vitro [2,16–18]. The ability of meniran (P. niruri L) as an antibacterial has been widely studied, however, the information on the effect of giving Phylanthus niruri L. powder on carcass weight and digestive tract is still limited [19,20].

Carcass is a part of a chicken's body after being slaughtered without blood, feathers, head, legs, neck and internal organs, which consists of several parts, namely the legs (upper and lower thighs), breast, back, and wings [8]. Parts of the carcass such as the breast, upper thighs, lower thighs can increase their economic value because some consumers like only one part of the carcass, for example, they like only the lower thighs. Slaughter age, sex, genetics, nutritional intake, environment, additives, and stress are all factors that can affect carcass production/weight [21].

Chicken growth is influenced by the development of muscle tissue, blood circulation, digestive system, and nervous system [12,22,23]. However, genetics, sex, strain, age, and health affect the growth of chicken muscle tissue and digestive system [14,22–24]. An important influence on the development of muscle tissue (carcass), weight and length of the digestive tract is the type and amount of feed ingested. Thus, a study was conducted to evaluate the application of Phyllanthus niruri L. (meniran) powder to the relative weight of carcass, upper thighs, lower thighs, back, breast, wings, and relative length of the intestine, duodenum, jejunum and ileum of broiler chickens.

2. Method

2.1. Preparation of Phyllanthus niruri L. (Meniran) powder
Meniran plants were collected which were taken in the Bogor area, then dried in an oven for 4–5 days, then mashed using a laboratory blender. After mashing, it is obtained P. niruri L powder (MP) and is ready to be used as a feed additive that is mixed into the broiler chicken ration.

2.2. Experimental design
This study used a Completely randomized design (CRD) with 5 treatments, 4 replications, each of which consisted of 10 hens and 200 broilers in total with the following treatments: T1 (without antibiotics and Phylanthus niruri L powder as negative control; T2 (Zn-bacitracin antibiotic 0.05%) as a positive control; T3 (Phylanthus niruri L. powder 0.0157%); T4 (Phylanthus niruri L. powder 0.0313%); T5 (Phylanthus niruri L. powder 0.0470%).

2.3. Management
The research was carried out in an experimental cage using 200 DOC chickens (day old chickens) Ross strain which were placed on top of the litter with husk material and maintained for 28 days. Diets containing iso protein (22%) and energy metabolism (3050 ccal) were formulated using corn, meat bone meal, soybean meal, bran, CPO, DCP, rock flour, sodium carbonate, DL-Methionine, lysine, threonine, salt, choline Cl, vitamins and minerals. Vaccination of Marek vaccine was carried out on DOC (day old chicken) via eye drops, 5 days-old for ND-Lasota vaccine via eye drops, 7 days-old gumboro 1 (Infectious Bursal Disease A) vaccine, and 21 days-old gumboro 2 (Infectious Bursal Disease B) vaccine. At the end of the study, in each replication, 2 chickens were weighed, then cut to measure the carcass, upper thighs, lower thighs, breast, back, wings, and small intestine (duodenum, jejunum, ileum).

The relative weight and length of the small intestine. First, the whole small intestine is weighed, then divided into 3 parts, namely the duodenum (from the gizzard to the end of the pancreatic loop), jejunum (from the pancreatic loop to Meckel's diverticulum), the ileum (from Meckel's diverticulum to 1cm above the ileocecal junction). After being divided into three, each small intestine (duodenum, jejunum, ileum) was weighed. Relative weight calculations were as follows:
Relative organ weight \( \% \) = \( \frac{\text{organ weight (g)}}{\text{live weight (g)}} \times 100\% \)  

(1)

Furthermore, the length of the small intestine (duodenum, jejunum, ileum) is measured. Small intestine length (duodenum, jejunum, ileum) are shown based on the proportion of the live weight of chickens. Relative length calculations were as follows:

Relative organ length \( \text{(cm/100 live weight)} \) = \( \frac{\text{organ length (cm)}}{\text{live weight (g)}} \times 100 \)  

(2)

2.4. Statistic analysis
Data were analyzed using ANOVA (analysis of variance) through the GLM procedure with SAS General Linear Models (1997) software. If the data were significantly different \( (P<0.05) \) between treatments then the Duncan test was continued [25].

3. Results and discussion
3.1. Relative weight of carcasses
Live weight and relative weights of carcass, breast, upper thighs, lower thighs, wings, back, head + neck, legs, and abdominal fat were not significantly different \( (P>0.05) \) between all treatments (table 1). This indicates that giving \( P. \ niruri \) L powder up to 0.0470% has the same effect as zn-bacitracin antibiotics on live weight and relative weight of carcass, upper thighs, lower thighs, wings, back, head + neck, legs, and abdominal fat in broiler chickens. Administration of \( P. \ niruri \) L powder up to 0.0470% showed the ranges of relative weight of carcass from 62.73–63.68%. The same result was reported [8,24,26] that carcass weight was around 62.21% at 28 days-old chicken. Provision of \( Phyllanthus \) buxifolius powder at a dose of 5% on the contrary reduces carcass weight around 5.2–13.3% of 28 to 42 days-old chicken [26,27]. Indicated that the administration of \( P. \ niruri \) L powder up to 0.0470% can still be used without affecting the carcass relative weight. The relative weights of back, upper thighs, lower thighs, and wings were not significantly different \( (P>0.05) \) between all treatments. The same result was reported [22–24] that the provision of mixed herbs (turmeric rhizome powder, mangrail seed, methi seed, neem leaves, tulsi leaf, \( Aloe \ vera \) leaf, garlic bulb, punarnava root, ashwagandha root and bhuiamala root) at a dose of 1–2% did not affect the relative weight of the upper thighs, lower thighs, and wings.

The effect of \( P. \ niruri \) L powder up to 0.0470% in broiler chickens showed the same relative weight of abdominal fat with Zn-bacitracin antibiotic treatment. On the other hand, the administration 5% \( Phyllanthus \) buxifolius powder can reduced abdominal fat weight 28–42 days-old chicken [26]. This indicates that at a dose of 0.0470% \( P. \ niruri \) L powder or low doses could not reduce the weight of abdominal fat. Relative weight of breast was significantly \( (P<0.05) \) higher in \( P. \ niruri \) L powder treatment at a dose of 0.0470% compared to Zn-bacitracin antibiotic treatment and \( P. \ niruri \) L powder at a dose of 0.0157 and 0.0131% (table 1). The process of forming the number of myofibers/muscle fibers has occurred before hatching, muscle growth depends on the speed of the length and diameter of the myofibers after hatching, so the size of myofibers is a determining factor in muscle volume [7]. So that the longer and wider the diameter of the myofiber, the higher the muscle muscle growth. Previous study [1,13,19] reported that chicken breast weight has a positive correlation with myofiber density. Indicated that \( P. \ niruri \) L powder at a dose of 0.0470% had a role in extended and expanded the diameter of myofibril tissue in the breast. So that the relative weight of the breast on \( P. \ niruri \) L powder treatment at a dose of 0.0470% was better than that of Zn-bacitracin and \( P. \ niruri \) L powder treatments at a dose of 0.0157 and 0.0131%. Some researches [18–20,22] reported the same results, that giving at dosage 2% \( Phyllanthus \) amarus extract was significantly better than dosage 1 and 1.5% in increasing the breast weight of broiler chickens. Mixtures of herbs up to 2% in broilers could also increase breast weight [28]. However, Lipinski et al (2019) reported that provision 0.05% herbs did not show a different percentage of breast and abdominal fat between those who were given herbs and those who were not given herbs on broiler [18].
Table 1. Effect of *P. niruri* L powder on relative live weight, carcass, breast, upper thighs, lower thighs, wings, back, hackle, neck, shank, and abdominal fat of 28 days-old broilers.

| Relative weight (%) | T1       | T2       | T3       | T4       | T5       | Probability |
|--------------------|----------|----------|----------|----------|----------|-------------|
| Body weight, g     | 1156.4   | 1188.8   | 1249.5   | 1093.4   | 1107.5   | 0.0874      |
| Carcasses          | 63.55    | 64.40    | 63.10    | 63.68    | 62.73    | 0.5055      |
| Breasts            | 25.02ab  | 22.76bc  | 20.08c   | 22.85bc  | 27.15a   | 0.0104      |
| Upper thighs       | 10.35    | 11.33    | 10.14    | 9.89     | 10.33    | 0.3536      |
| Lower thighs       | 8.86     | 9.47     | 8.77     | 9.26     | 8.88     | 0.0796      |
| Wings              | 7.32     | 7.89     | 7.07     | 7.37     | 7.25     | 0.0798      |
| Backs              | 13.86    | 13.97    | 13.5     | 13.66    | 13.67    | 0.7696      |
| Hackle+neck        | 6.29     | 6.39     | 6.28     | 6.46     | 6.22     | 0.9538      |
| Shanks             | 3.67     | 3.66     | 3.5      | 3.71     | 3.7      | 0.6692      |
| Abdominal fats     | 0.7      | 0.77     | 0.64     | 0.7      | 0.77     | 0.9566      |

T1 (without antibiotics and *P. niruri* L powder as negative control; T2 (Zn-bacitracin antibiotic 0.05%) as a positive control; T3 (*P. niruri* L powder 0.0157%); T4 (*P. niruri* L powder 0.0313%); T5 (*P. niruri* L powder 0.0470%). Values in any column having different subscripts were significantly different (P<0.05).

3.2. Relative weight of the small intestine (duodenum, jejunum and ileum)

Figure 1. Relative weight (g/kg body weight [BW]) of total intestine, duodenum, jejunum, a88end ileum at 28 days-old broiler. T1 (without antibiotics and *P. niruri* L powder as negative control; T2 (Zn-bacitracin antibiotic 0.05%) as a positive control; T3 (*P. niruri* L powder 0.0157%); T4 (*P. niruri* L powder 0.0313%); T5 (*P. niruri* L powder 0.0470%). There was no significant difference (P>0.05) between all of treatments on relative weight of the digestive organs.
The relative weight of the small intestine (duodenum, jejunum, and ileum) was not significantly different (P>0.05) between all treatments (figure 1). Overall provisioning Meniran powder 0.0131 and 0.0470% could increase the weight of the small intestine, especially in the jejunum and ileum. Sadeghi et al (2012) reported that the administration of Thyme (Thymus vulgaris), cinnamon (Cinnamomum verum) and turmeric (Curcuma longa) powder through drinking water at 5 g/liter did not show any difference to the total relative weights of the intestine, duodenum, jejunum, and ileum [29].

![Figure 1. The relative weight of the small intestine (duodenum, jejunum, and ileum) between all treatments.](image1)

3.3. Relative length of the small intestine (duodenum, jejunum and ileum)

Research showed that the higher the P. niruri L powder level, the longer the relative length of the small intestine, duodenum, jejunum and ileum (figure 2). This indicates that the bioactive substances in P. niruri L plants played a role in stimulating the growth of intestinal cells so that they became more length. The most nutrient absorption occurs along the jejunum, so the longer the jejunum, the more nutrient absorption will be. In this study, it showed that the administration of meniran powder at doses of 0.0131

![Figure 2. Relative length (cm/kg body weight [BW]) of total intestine, duodenum, jejunum, and ileum at 28 days-old broiler.](image2)
and 0.0470 was better than zn-bacitracin antibiotic against the development of jejunal length. Interestingly, the higher the dose of \textit{P. niruri} L powder, the longer the ileum. On the surface of the ileum, there are many indentations called villi which function to expand the surface which acts to absorb nutrients. Thus, the longer the ileum is, the more villi area will be, so that nutrient absorption will increase. Previous study showed that increasing villi will also increase digestive capacity [11,17,22]. The other study reported that the administration of Thyme (\textit{Thymus vulgaris}), cinnamon (\textit{Cinnamomum verum}) and turmeric (\textit{Curcuma longa}) powder through drinking water at 5 g/liter dosage did not show any differences in the relative lengths of the intestine, duodenum, jejunum, and ileum [1,2,17,23].

The small intestine consists of three segments, namely the duodenum, jejunum and ileum [14,16,23]. The three parts of the small intestine have their respective roles in the absorption of nutrients that enter the digestive tract of chickens. The amount of nutrients absorbed is influenced by the surface area of the small intestine by the number of villi [5] and microvilli with the role of increasing absorption [4,6,14,16]. Thus, if the small intestine (duodenum, jejunum, and ileum) gets longer, the villi was indicated more and more, thus the opportunity to absorb nutrients is longer, this had a positive impact on chicken performance.

4. Conclusion
Administration of \textit{Phyllanthus niruri} L. (meniran) powder up to 0.0470% in broilers, showed results that were not significantly different from the Zn-bacitracin antibiotic on body weight, relative weight of carcass, back, breast, upper thighs, lower thighs, wings, back, head + hackle, shank, abdominal fat, also weight and length relative of the small intestine, duodenum, jejunum, and ileum. However, meniran (\textit{Phyllanthus niruri} L.) powder at a dose of 0.0470% better than Zn-bacitracin antibiotics for increasing the relative weight of broiler breasts.

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