The effectiveness of adding eco-enzymes in drinking water on production performance and carcass of Lohmann roosters

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ABSTRACT

Efforts to obtain healthy chicken meat production require feed additives to increase the growth and quality of poultry livestock. Eco-enzymes are one of the natural feed additives because they contain organic acids which can increase poultry production. This study aims to determine the effect of using eco-enzymes in drinking water on production performance, carcass quality and internal organs of Lohmann roosters. The study used a completely randomized design (CRD) with 4 treatments and 6 replications. The treatment was the administration of eco-enzymes in drinking water: P0 (control / without administration of eco-enzymes in drinking water), P1 (2.5 ml/liter of drinking water), P2 (5 ml/liter of drinking water) and P3 (7.5 ml/liter of drinking water). Variables observed were production performance, carcass quality internal organs. The results showed that the administration of eco-enzymes in drinking water had a significant effect ($P<0.05$) on body weight gain, FCR, live weight and carcass percentage of Lohmann roosters, but had no significant effect ($P>0.05$) on internal organs. The concluded that the administration of eco-enzymes in drinking water of Lohmann roosters at a dose of 7.5 ml/L can increase body weight gain 38.24%, improve carcass quality 4.44%, increase

feed efficiency of 30.61% and do not have a negative effect on internal organs of roosters Lohmann.

Keywords: Carcass, Eco-enzyme, Rooster Lohmann

INTRODUCTION

Lohmann rooster is a by-product of the commercial laying hen hatchery industry, because the main objective of commercial laying hen hatchery is the hen. The hatchery industry does not all produce hens, if the percentage is assumed to be 50% hens, then 50% will produce male chicks which will be rejected, because they are considered to have no economic value (Nova *et al*., 2020). Lohmann rooster still has the potential to be cultivated as a meat producer to meet the needs of animal protein, although its potential is not like that of broiler chickens. Efforts made to increase the productivity of Lohmann roosters in addition to providing good quality feed, namely the provision of feed additives in the form of acidifiers.

The use of feed additives in livestock feed and drinking water has the aim of spurring growth and producing good quality meat products. Organic acid is a common ingredient added to animal feed ingredients in the form of an acidifier which can have an acidic effect on the small intestine as a place for bacterial growth and development. Acidifier is a feed additive in the form of organic acids which have the benefit of protecting and protecting feed from damage caused by microbes and fungi as well as creating an acidic atmosphere in the small intestine.

The addition of organic acids in chicken feed and drinking water can increase the absorption of nutrients through the process of increasing the function of digestive enzymes, so that they can affect the digestion and absorption of protein (Macelline *et al*.,

2021). The addition of alternative ingredients serves as a feed additive in the form of a growth promoter and disease prevention in poultry. Eco-enzymes are the result of processing fruit and vegetable peel waste which are rich in benefits with various ingredients contained in these eco-enzymes, one of which is organic acids. The content of organic acids contained in eco-enzymes is expected to be an alternative acidifier that can contribute to the digestive process, due to the presence of acetic acid and lactic acid. Viza (2022), stated that eco-enzymes contain organic acids in the form of acetic acid and lactic acid produced from the fermentation process. Acetic acid is produced from the metabolic processes of bacteria that are naturally present in the skins of fruits and vegetables.

Giving acetic acid can be used as a natural acidifier in rations that can improve the availability of calcium in chickens, which plays a role in the rate of protein deposition. Protein an important role in the growth of poultry (Beski *et al*., 2015; Alagawany *et al*., 2016) because protein consists of groups of amino acids that will form tissues (He *et al*., 2021). Giving organic acids contained in eco-enzymes can increase the absorption of nutrients in the digestive tract for optimal carcass production growth. Protein absorption that takes place in the digestive tract will be more optimal with the addition of organic acids in drinking water which will improve growth performance and carcass quality and improve organ weight performance in Lohmann roosters.

MATERIALS AND METHODS

An animal feeding experiment was conducted at the experimental station, Department of Animal Science, Faculty of Agriculture, Universitas Sriwijaya. The poultrys were cared for according to the Animal Welfare Guidelines of the Indonesian Institute of Sciences. The approval of the experiment was granted by Universitas

Sriwijaya with approval number KPPHP-2023-1. The tools used consisted of digital scales, battery cages of 24 units with a size of 60x60x60 cm, feeders, drinking bowls, incandescent lamps 60 watts/unit. The tools used for making eco-enzymes are plastic bottles, scissors and knives. The material used was ninety-six DOC Lohmann roosters placed as many as four in each cage unit, starter feed (BR-1) and finisher feed (BR 2) produced by Japfa Comfeed Indonesia with feed composition in Table 1.

The research method used a completely randomized design consisting of 3 treatments and 6 replications. The treatment is the dose of eco-enzymes in drinking water, namely: T0: control, T1: 2.5 ml/l, T2: 5 ml/l and T3: 7.5 ml/l. Cleaning and disinfection is done before the cage is used. Places of feed, places of drinking water and cage equipment washed clean. Each cage unit was labeled with treatment and replication

Eco-enzymes is carried out based on Yulistia and Chimayati (2021); Fruit peels, vegetable residue, and palm sugar were weighed at a ratio of 10:3:1. All ingredients are put in a plastic jar and covered. Then store it at room temperature and not in direct sunlight. Release of gas in the jar is done in the first month by opening the jar lid for about 5 seconds. After 3 months, the bottle cap was opened and the solution was filtered to obtain eco-enzymes.

Consumption data and body weight gain were collected every week, carcass quality and internal organs were collected at the end of the study. Chickens were weighed for live weight, then slaughtered, feathered and internal organs removed for measurement of carcass and internal organs. Feed consumption is calculated every week. Based on feed consumption, energy consumption and protein consumption are calculated. FCR is calculated based on the comparison between the amount of feed consumption and body weight gain. Consumption of drinking water is calculated from the difference between

the drinking water given and the remaining drinking water. The percentage of carcass parts is obtained by calculating the weight percentage of carcass parts (thighs and breasts).

Data were analyzed using analysis of variance according to a Completely Randomized Design, if there were significant differences, followed by Duncant's Multiple Range Test (Steel and Torie, 1995). Data processing has used SAS Version 9.1 software. (SAS. 2002).

RESULTS AND DISSCUSION

Feed consumption, protein consumption, energy consumption, drinking water consumption, weight gain and ration conversion: The results of the analysis of variance showed that the administration of eco-enzymes had no significant effect (P>0.05) on feed consumption in the starter and finisher phases. The average feed consumption in the starter phase was 22.77-23.34 g/head/day and in the finisher phase 149.22-151.34 g/head/day. The energy consumption of the starter phase is 66.03-67.80 Kcal/head/day and the finisher phase is 447.66-454.02 kcal/head/day. Consumption of protein in the starter phase is 5.01-5.14 g/head/day and the finisher phase is 29.84-30.27 g/head/day. Feed is consumed for nutrient and energy needs (Ogunlade *et al*., 2013; Classen, 2017). Addition of eco-enzyme in drinking water had no significant effect (P>0.05) on consumption of drinking water. In accordance with Orakpoghenor *et al*. (2021) that the average chicken consumes drinking water around 1.6-2 times the feed consumption.

The addition of eco-enzymes had a significant effect (P<0.05) on body weight gain and FCR. The addition of eco-enzymes in drinking water can increase the absorption of food substances through the stability of the pH of the small intestine by increasing the function of digestive enzymes to digest fiber and protein, because eco-enzymes contain organic acids which can increase the work of digestive enzymes through stability of the

pH of the small intestine (Li *et al*., 2019 ; Ma *et al*., 2021) and reduce pathogenic bacteria, according to Panda *et al*. (2009) the addition of 0.6-1% formic acid in feed can reduce the number of Escherchia in the small intestine and caecum of broiler chickens.

Based on the results of further tests that T0 has the same effect (P>0.05) as T1, but different (P<0.05) with T2 and T3. Addition of eco-enzymes at the level of 5 ml/L up to 7.5 ml/L of drinking water can increase body weight gain, so that the FCR is better than without addition of eco-enzymes. Even though consumption was the same in all treatments, it resulted in better weight gain in chickens was added eco-enzymes in water drinking. Rusdianasari *et al*. (2021) who reported that the organic acids contained in ecoenzymes were acetic acid and lactic acid. The addition of 0.5% citric acid can improve the performance of the digestive tract of broiler chickens (Das *et al*., 2012).

Carcass quality: The addition of eco-enzymes had a significant effect (P<0.05) on live weight and carcass percentage, but had no significant effect (P>0.05) on the percentage of breast slices and the percentage of thigh slices, as shown in Table 3. The difference in live weight resulted from an increase in weight gain in Lohmann roosters. The addition of eco-enzymes up to a level of 7.5 ml/L of drinking water increased live weight and carcass percentage of Lohmann roosters. This is due to the administration of eco-enzymes improving the absorption of nutrients, resulting in more optimal weight gain compared to without eco-enzymes. Administration of organic acids can increase carcass weight in the finisher phase (Dehghani and Jahanian, 2016), organic acids can increase the width and height of the intestinal villi in the duodenum, jejunum and ileum (Haq *et al*., 2017), thereby increasing the cross-sectional area of the intestine for absorption of nutrient.

Eco-enzymes administration had no significant effect (P>0.05) on breast carcass

and thigh carcass slices. The percentage of breast incisions produced in each treatment ranged from 26.29% - 28.68%. Giving eco-enzymes had no significant effect (P>0.05) on the percentage of thigh slices. Percentage of the thigh ranged from 18.63% - 20.92%. The results of this study are higher than those of Rahmawati *et al*. (2020), that breast carcass slices range from 12% - 15% and breast parts range from 15.5% - 18%. Addition of eco-enzymes can increase the percentage of carcass slices because eco-enzymes contain several organic acids which are able to stimulate the intestinal mucosa and reduce the population of pathogenic bacteria in the intestine (Garcia *et al*., 2007), improve the absorption of protein and fat (Nguyen and Kim, 2020 ; Ma *et al*., 2021; Palupi *et al*., 2022), so that it can increase nutrient deposition to form tissues.

Internal organs: The results of the analysis of variance showed that the administration of eco-enzymes in drinking water had no significant effect (P>0.05) on the percentage of liver weight of Lohmann roosters. The average liver weight in this study ranged from 35.58 to 37.69 with a percentage of liver weight ranging from 2.19% to 2.40% of live weight. The results of the analysis of variance on heart weight showed that administration of eco-enzymes in drinking water had no significant effect (P>0.05) on heart weight and heart weight percentage of Lohmann roosters. The mean heart weight in this study ranged from 8.55 – 9.49 with a heart weight percentage of 0.53% - 0.60%. In accordance with the results of Herlina and Ibrahim's research (2019) that the percentage of normal heart weight is between 0.42 - 0.70 of live weight.

The results of the analysis of variance showed that the eco-enzyme treatment had no significant effect (P>0.05) on the percentage of gizzard weight of Lohmann roosters. The average gizzard weight in this study ranged from 23.92 – 24.98g with a percentage of gizzard weight ranging from 1.47 – 1.59% of live weight. The percentage of gizzard

weight is still within the normal range according to Sturkie (2000), namely 1.6% -2.3%. The results of the analysis of variance of eco-enzyme administration had no significant effect (P>0.05) on the percentage of spleen weight of Lohmann roosters. The average spleen weight of Lohman cocks in this study ranged from 2.50 – 2.70g with a percentage of spleen weight ranging from 0.15% - 0.17% of live weight. The percentage of spleen weight in this study was higher when compared to the results of Dorisandi *et al*. (2019) that the lymph weight of native chickens ranges from 0.33% - 0.41%.

Based on Table 4. shows that administration of eco-enzymes in drinking water does not negatively affect the weight and percentage of internal organs, both in the liver, heart, gizzard and spleen. In laying hens the average heart weight is 1.52 ± 0.05; liver 8.09±1.05; pancreas 1.24 ± 0.13 and spleen 0.451 ± 0.08 with a heart rate of 0.60 ± 0.06; liver 8.09±1.05; pancreas 0.49 ± 0.04 and spleen 0.177 ± 0.030 (Krishnan *et al*., 2021). Percentage average organ weights recorded 0.40 for heart, 2.51 for liver, 2.12 for gizzard, 0.09 for spleen and 3.89 for the intestine. The percentage range of the live weight of the birds was 12.79 while those of the internal organs were 0.06 for heart, 0.52 for liver, 0.47 and gizzard, 0.01 spleen and 0.21 for intestine (Iwuji *et al*., 2022).

The results of the study showed that the addition of eco-enzymes in drinking water at a dose of 7.5 ml/L increased body weight gain by 38.24% and increased carcass weight by 4.44%, increased feed efficiency by 30.61%, and did not negatively affect the internal organs of Lohmann roosters.

AUTHORSHIP CONTRIBUTRION STATEMAENT

Authors' contributions All authors developed the theory and supervised the research. Rizki Palupi contributed to the sample collection and analysis calculations. All authors read and approved the final version of the manuscript for publishing in the present

journal.

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Table 1. Nutritional content of BR 1 and BR 2 rations

Nutrients	Starter (BR 1) 1-2 week	Finisher (BR 2) 3-10 week
Water content (%)	14	14
Protein (%)	21-22	20-21
Fat (%)	Min 5	Min 5
Fiber (%)	Max 6	Max 6
Ash (%)	Max 8	Max 8
Calcium (%)	0,8-1,1	0,8-1,1
Phosphor (%)	Min 0.45	Min 0.45
ME (Kcal/Kg)	2900-3100	3000-3100

Source: Japfa Comfeed Indonesia, Tbk.

Table 2. Effect of treatments on feed consumption, protein consumption, energy consumption, drinking water consumption, body weight gain and FCR of Lohmann roosters

Parameter	T0	T1	T2	T3
Feed consumption (starter)	23.34 ± 4.23	22.77 ± 2.77	23.22 ± 4.81	23.28 ±6.29
Feed consumption (finisher)	151.34 ± 1.72	149.77 ± 1.06	149.22 ±1.29	149.28 ±1.25
Protein consumption (starter)	5.13 ± 3.03	5.01 ± 2.24	5.11 ±1.45	5.14 ± 3.43
Protein	30.27 ± 4,00	29.95 ± 6,23	28.84 ± 7,21	29.86 ±7.19

consumption (finisher)				
Energy consumption (starter)	67.69 ± 6.63	66.03 ± 8.91	67.34 ± 6.13	67.80 ± 7.51
Energy consumption (finisher)	454.02 ± 9,81	449.31 ± 7.77	447.66 ± 7,83	447.84 ± 7.16
Drinking water consumption	160.20 ± 1.19	170.10 ± 1.06	160.40 ± 0.74	170.80 ± 1.74
Body weight gain*	20.92^{a} ± 6.65	22.76^{a} ± 5.84	28.66^{b} ± 2.41	28.92^{b} ± 3.70
FCR*	2.45^{a} ± 0.77	2.19^{a} ± 0.71	1.71^{b} ± 0.45	1.70^{b} ± 0.50

(*) significant effect (P <0.05).

Table 3. Effect of treatments on live weight and carcass of Lohmann roosters

Parameter	T0	T1	T2	T3
Live weight (g)	1569.09^{a}±0.04	1617.20^{b}±0.08	1630.11^{b}±0.07	1622.00^{b}± 0.05
Carcass (%)	60.49^{a} ± 2.15	62.54^{b}± 1.03	63.49^{b}± 2.93	63.18^{b} ± 3.01
Breast carcass slices (%)	26.41^{a}±2.08	26.20^{a} ±304	28.68^{b}±1.23	28.52^{b} ± 2.25
Thigh carcass slices (%)	18.63^{a} ± 2.05	19.79^{a} ± 3.04	19.62^{b} ± 2.92	20.92^{b} ±3.48

(*) significant effect (P <0.05).

Table 4. Effect of treatments on internal organs of Lohmann roosters

Trait	T0	T1	T2	T3
Liver (g)	37.69±0.29	35.86±0.28	36.75±0.43	35.58±0.17
Liver (%)	2.40±0.11	2.22±0.13	2.25±0.21	2.19±0.23
Heart (g)	9.49±0.04	8.55±0.09	9.53±0.08	8.56±0.05
Heart (%)	0.60±0.22	0.53±0.13	0.58±0.26	0.53±0.31
Gizzard (g)	24.98±0.52	24.97±0.39	23.92±0.63	24.36±0.47
Gizzard (%)	1.59±0.09	1.54±0.12	1.47±0.33	1.50±0.17
Lymph (g)	2.53±0.20	2.70±0.29	2.55±0.21	2.50±0.11
Lymph (%)	0.16±0.27	0.17±0.18	0.16±0.24	0.15±0.29