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Ration Formulation of Native Chicken from Fruit Fly *(Drosophila melanogaster* L.) and Water Hyacinth Flour *(Eichornia crasipess* (Mart.) Solms)

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Abstract

Fruit flies and water hyacinths are believed to be able to increase body weight in native chickens because they have a relatively high protein content. This study aims to determine the effect and dose of fruit fly (*Drosophila melanogaster* L.) with a combination of water hyacinth flour (*Eichornia crassipes* (Mart.) Solms) for consumption and body weight gain in native chickens (*Gallus domesticus* L.). The method used in this study used a Completely Randomized Design (CRD) method. Where this study was an experimental study using five treatments and four replications. The results showed that the average consumption of free-range chicken rations was 30.41 g per head per week, where P1 was the highest ration consumption at 6.75 g per head per week, and the lowest was at P4 at 5.72 g per head per week. On body weight gain, native chickens had an average of 11.42 g per head per week, where P2 had the highest average of 2.39 g per head per week and P1 with the lowest average of 2.13 grams per week. The consumption of free-range chicken rations tends to increase along with the composition of water hyacinth in the ration to 7.5%.

Keywords: *fruit flies, water hyacinth, native chicken, fermentation, ration*

INTRODUCTION

Free-range chicken (*Gallus domesticus* L.) is a group of domestic fowl that can produce eggs and meat and has been developed by the local community, especially in rural areas. Free-range chickens can adapt well to their surroundings (Fitria et *al*., 2016). The ration consumed by native chickens generally is a source of energy and protein in the body, which plays a vital role in developing and repairing tissues and managing production. Protein in the ration plays an important role in body weight gain in native chickens. Protein is part of the enzyme structure and a crucial part of forming body cells and tissues because it plays an important role in achieving the desired carcass weight (Fitria et *al*., 2016). The mixed ration given by native chicken breeders is generally a mixture of rice bran and groats (Azzamy, 2017).

The Indonesian Association of Local Poultry Breeders in 2021 stated that the development of free-range chickens is currently being encouraged due to the pandemic. In 2021 the surplus of chicken meat

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will reach 344,967 tons which is 9.8% of the demand. This surplus was estimated before the Covid-19 pandemic took place. On December 10, 2020, the National Poultry Discussion estimated that the profit for chicken meat production in December 2020 would be 18.7%, while the profit for purebred eggs in 2021 would reach 119,852 tons or the equivalent of 2.4% (Ministry of Agriculture, 2020). Efforts to increase the growth and development of native chickens require good protein content in the ration. Ration with good quality can also show promising results in chicken body weight gain, one of which is with a ration that contains high protein. A high protein ratio can affect protein intake, where amino acids can be appropriately fulfilled in the chicken's body (Fitria et *al*., 2016). Efforts to increase the productivity of free-range chickens require finding substitute feed ingredients, namely with other feed ingredients that are cheaper, easy to obtain, and have high nutritional content. One of the substitutes is to utilize the leftovers from the agricultural industry, such as rice bran. Bran is a feed source derived from rice plants which can be used as a mixture in poultry rations because it contains many nutrients such as protein, vitamins, and various minerals (Fitria et *al*., 2016).

The fruit fly (*D. melanogaster* L.) is a type of insect belonging to the Drosophilidae family. D*. melanogaster* L. has an important role in the development of Biology and in studying the basics of genetics (Sumampouw et *al*., 2017). *D. melanogaster* L. was the first organism to be studied genetically because of its small size, short life cycle (10-14 days at 25oC), high reproductive rate (an adult female can lay 400-500 eggs in 10 days), can be easily cultivated. Genetic manipulation makes *Drosophila melanogaster* L the most easily understood genetic animal by the system. Fruit flies have a variety of species, the number of which is large and wide, various types are formed naturally, and there are also genetic variants obtained through the help of human hands (Sumampouw et *al*., 2017). *D. melanogaster* L. also has potential as a poultry feed because it has a relatively high protein content of 63.25%. A feed with high protein content plays an important role in production quality. The reproductive cycle of *D. melanogaster* L. is also high-speed and suitable for animal feed because the nutritional composition is fulfilled, and its availability is abundant (Aini, 2008).

Water hyacinth which has the Latin *Eichornia crassipes* (Mart.) Solms) is a plant that lives in water, such as rivers, reservoirs, and also lakes. Water hyacinth has a negative effect on the environment because of its rapid growth, which can reach 3% in a day. This makes the surface where these plants live can be covered. *Water hyacinth* is a nuisance plant that can have a negative impact and harm humans. In addition, it can make river or reservoir water shallow and cause water evaporation and decreased nutrients (Mahmila, 2005). The results of chemical tests indicated that water hyacinth contains minerals, vitamins, and fat. Moreover, the protein content is relatively high, ranging from 12% to 18%, and contains complete amino acids (Muchtaromah et *al*., 2012). A *good ration* is a ration that contains various kinds of nutrients, such as protein, carbohydrates, fats, proteins, minerals, and vitamins (Fitriyanti, 2019).

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MATERIALS AND METHOD

The materials used include fruit flies (*D. melanogaster* L.) and water hyacinth (*E. crassipes* (Mart.) Solms) as the main ingredients and EM4, salt, sugar, and water for the manufacture of fermented hyacinth and rice bran as a ration mixture.

Making Water Hyacinth Flour

The water hyacinth is first soaked in a holding tank and washed to remove any remaining dirt, then drained and air-dried until dry, after which the water hyacinth is ground until smooth.

Making Fermented Water Hyacinth Flour.

Approximately 100 grams of water hyacinth was prepared and mixed homogeneously with EM4 as much as 10% of the weight of water hyacinth flour, then added 0.25 kg of brown sugar was as a nutrient and homogenized. After that, put it in a plastic bag, place it at room temperature of 37°C and let it stand for seven days. After seven days, the water hyacinth flour was removed and dried.

Preparation of Rations.

Rice bran was weighed according to the ration composition determined for each treatment. A combination of fruit flies and fermented hyacinth flour was added according to the level of the treatment. In treatment, P0 was not given fruit flies with fermented water hyacinth flour but rice bran in the ration. To avoid rancidity, mixing the concentrate is done daily and manually.

Cage Preparation.

The cage was first disinfected using a Rodalon and left for three days. The cage equipment used is also cleaned before use.

Maintenance of Experimental Animals.

The body weight of the chickens was first weighed and then put into battery-type cages, where each cage was filled with three chickens. Treatment of fruit flies and fermented water hyacinth flour in rations was given for four weeks, with each dose determined for each treatment. The amount of ration given is approximately 120 grams for each chicken every day, and the rations are given every day at 07.00 WITA and 13.00 WITA, where this time is a comfortable ambient temperature for chickens, and drinking water is given ad-libitum or always available.

RESULTS AND DISCUSSION

Results of Measuring Consumption of Free-range Chicken Ration

The results of measuring the consumption of free-range chicken rations per head in the first week to the fourth week obtained the highest average ration consumption in treatment P1 of 6.75 gr/week while the lowest ration consumption was in treatment P4 of 5.72 gr/week. In control, the average ration consumption was 5.77 gr/week (table 1).

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Table 1. Average consumption of free-range chicken (*G. domesticus* L.) 1-4 weeks old (g per head per week)

Treatment	Repetition				Total	Rarely
	1	2	3	4		
P0	6,2	6,1	5,6	5,2	23,1	5,77
P1	7,5	7,2	5,8	6,5	27,0	6,75
P2	6,2	6,1	6,1	6,1	24,5	6,12
P3	5,7	6,7	6,8	5,0	24,2	6,05
P4	6,3	5,2	5,9	5,5	22,9	5,72
Total rarely					121,7	30,41

ANOVA test

The results of the analysis of the diversity test or ANOVA test of native chicken ration consumption showed that fruit flies and water hyacinth had a significant effect (P<0.05) on free-range chicken ration consumption (table 2).

Table 2. Results of the ANOVA test on the consumption of free-range chicken rations

Source of Variation	df	SS	MS	F value	sig
Treatment	4	2,683	,671	1,905*	,008
Error	15	5,282	,352		
Total	19	7,966			

Remarks*: Real

BNT Test

The results of a minor significant difference test or BNT test for native chicken ration consumption at different letter notations show a significant difference (table 3).

Table 3. Results of the BNT test on the consumption of free-range

Treatment	Average	Notation
P_0	5,77	a
P_1	6,75	b
P_2	6,12	ab
P_3	6,05	ab
P_4	5,72	a

Results of Measurement of Free-range Chicken Body Weight Gain

The results of measuring the body weight gain of native chickens per head in the first week to the fourth week obtained the highest average weight gain in P2 of 2.39 g/week while the lowest was in treatment P1 of 2.13 gr/week (table 4).

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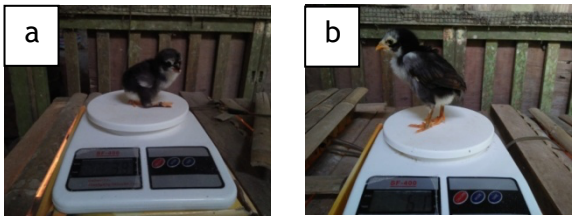
Table 4. Average free-range chicken (*G. Domesticus* L.) body weight gain (g per head per week)

Treatment	Repetition				Total	Rarely
	1	2	3	4		
P0	2,35	2,37	2,20	2,40	9,32	2,33
P1	1,92	1,80	2,45	2,37	8,54	2,13
P2	2,45	2,37	2,37	2,37	9,56	2,39
P3	2,37	2,22	2,10	2,35	9,04	2,26
P4	2,22	2,30	2,42	2,32	9,26	2,31
Total Rarely					45,72	11,42

The body weight gain of native chickens was obtained from the results of weighing the body weight of the chickens every week.



Picture 1. a) body weight of chickens (*G. domesticus* L.) 1 day old, b) body weights of chickens 4 weeks old

Discussion

Measuring free-range chicken ration consumption

The highest average consumption of free-range chicken rations was found in treatment P1 of 6.75 g/head/week, followed by treatment P2 of 6.125 g/head/week, treatment of P3 of 6.05 g/head/week, treatment of P0 of 5.775 gram/head /week, and the lowest was in the P4 treatment of 5.725 g/head/week. It can be concluded that the highest average free-range chicken ration consumption was in treatment P1 with a dose of 2.5% fruit flies + 10% water hyacinth in the ration of 6.75 g/head/week. The lowest average free-range chicken ration consumption was in the P4 treatment, with a dose of 10% fruit flies + 2.5% water hyacinth in a ration of 5.72 g/head/week. The results obtained in this study indicate that the higher the dose of water hyacinth in the ration, the more free-range chicken rations will also tend to increase.

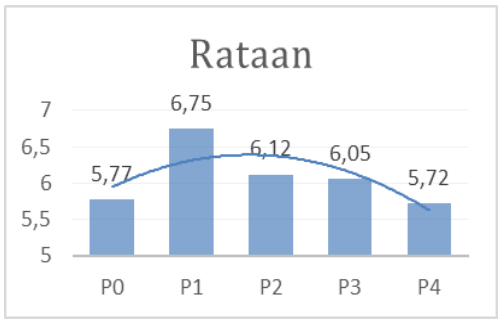


Figure 2. Histogram of the difference in average free-range chicken ration consumption for each treatment

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ANOVA Test

Analysis of variance or ANOVA test showed that the ration formulation of fruit flies with a combination of water hyacinth powder had a significant effect (P<0.05) on free-range chicken ration consumption. The fermentation process in water hyacinth can change the nutritional and flavor content in feed ingredients for the better so that the palatability of the ration increases, which results in high ration consumption in chickens. Other influencing factors such as health, climate, palatability of rations, color, shape, smell, and body weight can also affect ration consumption in chickens (Saleh et *al*., 2005).

BNT Test

The BNT test results showed that P0 and P5 could significantly affect P1 but had no significant difference on P2 and P4. At P2 and P3, it showed no significant effect on P1, P2, and P3.

Measuring the Body Weight Gain of Free-range Chickens

The body weight gain of native chickens was obtained from a comparison between the final weight (harvest) and the initial weight with the length of maintenance (Saleh et *al*., 2005). Table 4 shows the highest average body weight gain of native chickens, namely in treatment P2 of 2.39 grams per head per week, then in treatment P0 (control ration) of 2.33 grams per head per week, in treatment P4 of 2 .31 gr per head per week, the P3 treatment was 2.26 g per head per week. The lowest was in the P1 treatment of 2.13 g per head per week. This shows that free-range chicken ration consumption tends to increase with increasing water hyacinth composition in the ration by up to 7.5%. namely in the P2 treatment with a dose of 5% fruit flies + 7.5% water hyacinth. While the less effective dose was in treatment P1 with 2.5% fruit flies + 10% water hyacinth, where the dose did not show a significant effect on free-range chicken body weight gain. Doses of water hyacinth above 15% can cause bulkiness to be higher. It can affect the cache space in chickens, resulting in their nutritional needs not being met and inhibiting their growth of chickens (Noferdiman et *al*., 2018).

The results of this study indicated that fruit flies and water hyacinth flour did not significantly affect free-range chicken body weight gain. The nutritional content found in fermented fruit flies and water hyacinth flour in general rations did not affect their body weight gain. Factors affecting the low body weight of free-range chickens in this study were also due to cold environmental conditions, which caused the chickens to experience colds. Other factors such as environmental factors, chicken health, the nutritional value of the food contained, genetics, the balance of substances in food, and stress in chickens will significantly affect the chicken's body weight gain (Utami, 2021). Ration consumption is also influenced by several factors, including body size, daily activities, ambient temperature, quality, and quantity of rations (Rusli et *al*., 2019)

CONCLUSION

The ration formulation of fruit flies (*D. melanogaster* L.) and water hyacinth flour (*E. crassipes* (Mart.) Solms) did not have a significant effect on body weight gain in native chickens (*G. domesticus*

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L.). Consumption of free-range chicken rations tends to increase with increasing water hyacinth composition in the ration up to 7.5%.

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