THE EFFECT OF MAGGOT FLOUR (*Hermetia Illucens*) FROM LAYING CHICKEN MANUFACTURES AS A SUBSTITUTION FOR FISH MEAL IN THE ration ON QUAIL EGG PRODUCTION

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Abstract: *This research aims to determine the effect of giving maggot meal (hermetia illucent) from laying hen droppings as a substitute for fish meal in the ration on the production of quail (cortunix-cortunix japonica) eggs. The research design used was a completely randomized design (CRD) with 5 treatments and 4 replications. The treatments studied were as follows: P0 = ration containing 12% fish meal, P1 = ration containing 9% fish meal + 3% maggot meal, P2 = ration containing 6% fish meal + 6% maggot meal, P3 = ration containing 3% fish meal + 9% maggot flour, P4 = Ration contains 12% maggot flour. The research results obtained are the highest feed consumption was in treatment P0 at 19.40 grams/head/day which was very significantly different from the feed consumption in treatment P1 at 18.58 grams/head/day, P2 at 17.30 grams/head/day, P3 at 16 .60 grams/head/day, and the lowest feed consumption was in treatment P4 at 14.57 grams/head/day. The best ration conversion was found in treatment P2 with a ration conversion value of 2.04 which was not significantly different from treatment P3 of 2.18, P1 of 2.26, P0 of 2.53, and P4 of 2.56. The highest egg production was in treatment P0 at 85% and P2 at 84.25% which was very significantly different from the lowest egg production in treatment P4 with egg production at 64%. The highest egg weight was found in treatment P1 at 10.63 grams/piece, which was not significantly different from treatment P0 at 10.20 grams/piece, P2 at 10.19 grams/piece, P4 at 10 grams/piece, and treatment P3 at 9 .80 grams/item. The highest egg mass was found in treatment P0 at 8.68 grams and P2 at 8.53 grams, which was not significantly different from the egg mass in treatment P3 at 7.79 grams, P1 at 7.75 grams, and P4 at 6.23 grams.*

INTRODUCTION

The development of animal husbandry in Indonesia is accompanied by an increase in human resources, so knowledge about the importance of nutrition derived from livestock has resulted in increased demands for the fulfillment of livestock products as a

source of human nutrition. One of the needs for food products originating from livestock is eggs. quail. Quail eggs are popular with the public because they contain 13.6% protein, not much different from chicken eggs which have a protein content of 12.8%. Quail eggs are produced by female quail that are ready to lay eggs.

The female quail is a bird that is widely bred in Indonesia because of its fast egg production because at the age of 42 days the female quail is already producing eggs, in a year the quail can produce 250 - 300 eggs. To obtain optimal egg production, quail must be given feed that contains nutrients that suit their needs. One of the nutritional elements that must be sufficient is protein. To get protein that meets your needs, you need ration ingredients that have a high protein content. The commonly used protein feed ingredient is fish meal.

Fish meal is a protein source feed ingredient with a protein content of 55% - 62%. Apart from its high protein, the price of fish meal is also relatively expensive and you have to import it to get quality fish meal. Poultry ration formulations are usually always looking for alternative feed ingredients that are cheaper but have the same quality as fish meal. One of these alternative feed ingredients is maggot (*Hermetia illucent*). Maggot meal is an economically viable solution for farmers, given the high price of commercial feed (Siregar *et al*., 2022).

Maggots (*Hermetia illucent*) have a fairly high protein content, namely 45%. Maggots can be used as raw material for feed because they do not contain substances that are harmful to quail. Thus, maggot flour has the potential to be used as a substitute for fish meal for egg-laying quail feed formulations because maggot flour can provide good results for quail egg production. The maggot larvae are derived from the black fly (Hermetia illucens), which is commonly found on vegetables and fruit, and is also found in palm oil waste (Siregar *et al*., 2023). Based on the background description above, this research was conducted with the aim of examining "Providing Maggot Meal (*Hermetia Illucens*) from Laying Chicken Manure as a Substitute for Fish Meal in the Ration on Quail Egg Production".

RESEARCH METHODS

This research was carried out in Abadi Hamlet, Tandam Hilir II Village, Kec. Perak Perak District. Deli Serdang from March to May 2020. The materials used in this research were 100 quail aged 42-100 days. The ration used is a ration that is made by yourself with the ingredients used in preparing the ration are maggot flour, yellow corn, fine bran, soybean meal, fish meal, DDGS, oil, premix. The equipment used in this research was quail cages, brooms, feed containers, drinkers, scales, incandescent lamps, stationery and egg trays. The method used in this research was a completely randomized design (CRD) method which used 5 treatments and 4 replications. Where the treatment given is as follows:

P0 = Ration contains 12% fish meal
P1 = Ration containing 3% T.Maggot + 9% T.Fish
P2 = Ration containing 6% T.Maggot + 6% T.Fish
P3 = Ration containing 9% T.Maggot + 3% T.Fish
P4 = Ration containing 12% T.Maggot

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RESEARCH IMPLEMENTATION

Cage preparation

The cage used in this research was a battery colony cage with 20 plots consisting of five partitioned levels. Each plot measures 30 cm x 40 cm x 25 cm and each unit contains 5 quail.

Livestock Preparation

The research used 100 quail (coturnix-coturnix japonica) that were 50 - 100 days old.

Preparation for Making Maggot Flour

The maggots that have been cleaned are then dried in the oven at 600C until dry, after drying they are then blended to make them smooth. The ground maggot flour is stored in a dry place, then weighed according to the needs of the quail.

Feed Preparation

The ration used is a ration made by yourself with the ingredients used in preparing the ration are maggot flour, yellow corn, fine bran, soybean meal, fish meal, Dried Distillers

Grains with Solubles (DDGS), oil, premix. Then the ration is mixed with maggot flour according to the treatment.

Table 1. Composition of Treatment Ration Ingredients

Composition of Ration Materials	Ration composition (%)				
	P0	P1	P2	P3	P4
Corn	43.6	43.6	43.6	43.6	43.6
Bran	20	20	20	20	20
Soybean Meal	16.6	16.6	16.6	16.6	16.6
Fish flour	12	9	6	3	0
Maggot Flour	0	3	6	9	12
Premix	1.5	1.5	1.5	1.5	1.5
DDGS	4.3	4.3	4.3	4.3	4.3
Oil	2	2	2	2	2

Table 2. Nutrient Content of Treatment Rations

Metabolic Energy (kcal/kg)	2904	2967	3030	3093	3156
Crude protein (%)	21.45	20.75	20.05	19.35	18.65
Crude Fat (%)	5.10	5.68	6.26	6.85	7.43
Crude Fiber (%)	4.13	4.20	4.27	4.35	4.42

*Results of analysis carried out at Sahabat Laboratory.

Analytics and Data

The research data is analyzed using analysis of variance and if there are real differences it will be followed by a difference test with the coefficient of diversity of the research results.

Observed Parameters

In this study, the parameters observed were feed consumption, feed conversion, egg production, egg weight, egg mass and mortality

1. Ration consumption is the difference between the ration given and the remaining ration divided by the number of quail, expressed in grams/head/day.
2. Feed conversion is the quail's ability to convert feed into eggs which was calculated during the research.
3. Egg production, the number of eggs divided by the number of quail multiplied by 100%.
4. Egg weight is obtained from eggs weighed on a digital scale then averaged according to treatment and repetition, expressed in grams/item.
5. Egg mass is calculated by multiplying egg production by egg weight divided by population size.

RESULTS AND DISCUSSION

A recapitulation of research results on each parameter of the effect of giving maggot flour from laying hen droppings in the ration on feed consumption, ration conversion, egg production, egg weight and egg mass for quail aged 50 - 100 days is presented in Table 3.

Table 3. Recapitulation of data on ration consumption, ration conversion, egg production, egg weight and egg mass for quail aged 50 – 100 days who were given maggot meal from chicken droppings as a substitute for fish meal in the ration.

Treatment	Parameter Average				
	Ration Consumption (g/head/day)	Ration Conversion	Egg Production (%)	Egg Weight (g)	Egg Mass (g)
P0	19.40^{E}	2.26^{tn}	85.00^{D}	10.20^{tn}	8.86^{tn}
P1	18.58^{D}	2.53^{tn}	73.00^{B}	10.63^{tn}	7.75^{tn}
P2	17.30^{C}	2.04^{tn}	84.25^{CD}	10.19^{tn}	8.53^{tn}
P3	16.60^{B}	2.18^{tn}	78.00^{BC}	9.80^{tn}	7.79^{tn}
P4	14.57^{A}	2.56^{tn}	64.00^{A}	10.00^{tn}	6.23^{tn}

Note: Different superscript letters indicate different results at the level (P>0.01) and tn (not significantly different).

Ration Consumption

Ration consumption is the amount of ration consumed by quail livestock in a certain time with the aim of survival, body weight gain, and egg production. The results of the analysis of variance showed that the provision of maggot flour from chicken manure had a very significant effect on ration consumption. The results of the BNJ test showed that the treatment of maggot flour as a substitute for fishmeal in the ration as

much as 0% (P0), 3% (P1), 6% (P2), 9% (P3), and 12% (P4) was significantly different from the ration consumption. The average ration consumption of quail treated with P0, P1, P2, P3 and P4 were 19.40; 18.58; 17.30; 16.60; and 14.57, respectively. The lowest average ration consumption was found in treatment P4 with the addition of maggot flour as much as 12% in the ration. The higher the use of maggot flour in the ration, the lower the ration consumed by quail. The decrease in ration consumption is caused by the aroma caused by maggot flour and also the high fat content that affects the level of palatability of livestock to the ration. The results of this study are in line with the results of research by Ansyari *et. al*. (2012) which states that the use of higher maggot flour will have an impact on reducing the ration consumption of quail. This is because the composition of the fat content of the treatment ration is increasing so that quails experience excess calories which results in decreased ration consumption (Wuryadi, 2011). A different opinion was expressed by Mawaddah *et al*. (2018), which stated that the use of deffated BSF larvae flour mixed with other feed ingredients did not affect quail palatability. Harlystiarini *et al.* (2017) reported that the substitution of fishmeal with deffated BSF larvae flour did not have a significant effect on feed consumption.

The average ration consumption in the P4 treatment (Addition of 12% maggot flour) is not much different from the results of the research of Ansyari *et al*. (2012) which states that quail ration consumption is 15.24 grams / head / day with the addition of 12.49% maggot flour in the ration. However, the average ration consumption of the research results in the P2 treatment (Addition of 6% maggot flour) was lower than the results of the research of Mawaddah *et al*. (2018) which stated that the average consumption of quail rations was 22.66 grams / head / day with the addition of 6.18% maggot flour in the ration.

According to Setiawan (2006), quail consume feed to meet the needs of energy and other food substances, so that if energy needs are met then the quail will stop eating. The average ration consumption of quail aged 6-13 weeks is 22.24 grams/head/day (Triyanto, 2007). Likewise, in the research of Achmanu *et al*. (2011) that quail ration consumption was 21.05 grams/head/day.

Ration Conversion

Ration conversion is the ratio between the ration consumed and the egg mass produced at a certain time. The average ration conversion of quail from the P0, P1, P2, P3, and P4 treatments were 2.26; 2.53; 2.04; 2.18; and 2.56, respectively. The lowest average ration conversion was found in the P2 treatment of 2.04. The results of the analysis of variance showed that the provision of maggot flour from chicken manure had no significant effect ($P < 0.05$) on ration conversion. This is thought to be caused by the mass of eggs and the ability of livestock to convert rations into eggs so as to produce relatively the same ration conversion. The results of this study are supported by the opinion of Leeson and Summer (2009) that there are several factors that affect ration conversion, such as egg production, ration nutrient content, egg weight and environmental conditions (temperature and humidity). Mawaddah *et al*., (2018) Deffated BSF flour does not have a significant effect on quail ration conversion. Ration conversion value is closely related to ration consumption and the ability of livestock to convert

rations into meat and eggs. The lower the ration conversion rate, the more efficient the livestock is in utilizing the consumed ration. On the other hand, a lower ration conversion value can have a major effect on total production costs.

The average ration conversion of the results of this study is higher than the results of research by Maknun *et al*. (2015) which states that the average ration conversion of quail is 1.76. However, the ration conversion of the results of this study is much lower than the results of the research of Mawaddah *et al*. (2018) which states that the average ration conversion of quail fed with 6% maggot flour in the ration is 4.27. This opinion is supported by the results of research by Ansyari *et al*. (2012) which states that the average ration conversion given maggot flour as much as 12.49% in the ration is 4.43.

Egg Production

Egg production is the egg production during the study divided by the number of live quail multiplied by 100%. The average egg production of quail from the study ranged from 64% - 85% with an average egg laying percentage of 76.85%. The results of the analysis of variance showed that the provision of maggot flour from chicken manure had a very significant effect on egg production. The results of the Honest Real Differences (BNJ) test showed that the P4 treatment was significantly different from the other treatments, the P0 treatment was significantly different from the P1 and P3 treatments but not significantly different from the P2 treatment, and the P3 treatment was not significantly different from the P1 and P2 treatments. The higher the provision of maggot flour, the lower the egg production produced. This is caused by low ration consumption so that the intake of amino acids and other nutrients for the egg production process is insufficient. The above opinion is in accordance with the opinion of Wahju (2004), which states that the maximum use of energy for production purposes can be achieved if the ration contains amino acids and other substances that are balanced. In Widjastuti and Kartasudjana's research, (2006) explained that low energy consumption in poultry production can result in decreased production. Maknun *et al*. (2015), The availability of sufficient amino acids for egg formation will result in the same egg production.

A different opinion was expressed by Mawaddah i. (2018), in their research results stated that the provision of deffated BSF larvae flour in the ration did not have a negative impact on egg production or animal health. Newton *et al*. (2005) Substitution of 50 - 75% fish meal with BSF meal gives a positive response to quail egg production and weight, feed consumption rate and feed conversion. This can be understood because BSF meal has proteins with relatively similar amino acid characteristics to fish meal. According to Setyawan *et al*. (2013), the feed consumption rate was almost the same in each treatment, resulting in a similar percentage of egg production.

The average egg production of the research results given the addition of 6% maggot flour (P2) in the ration is 84.25%. The results of this study were higher compared to the results of research by Mawaddah *et al*. (2018) which showed that the average egg production of quail given 6.18% maggot flour in the ration was 51%. Setyawan *et al*. (2013) stated that the average egg production of 7-month-old quail was 82.68%. According to Nys and Guyot (2011), the peak of normal quail production ranges from 15 - 16 weeks of age, which is 90-95%.

Egg Weight

Egg weights were obtained from eggs weighed with digital scales and then averaged according to treatment and replication. The average weight of quail eggs until the age of 100 days in the P0, P1, P2, P3, and P4 treatments were 10.20; 10.63; 10.19; 9.80; and 10.00 grams, respectively. The results of the analysis of variance showed that the use of maggot flour up to the level of 12% in quail rations had no significant effect ($P<0.05$) on egg weight. The absence of a significant difference in egg weight is probably due to the influence of quail age so that egg weight has reached the standard. The average results of this study are relatively similar to the results of research by Setiawan (2006) that the average egg weight of quail aged 7 - 15 weeks is 10 - 12 grams. The results of this study are in accordance with the opinion of Triyanto (2007) which states that egg weights are getting higher in line with increasing age until a stable weight is achieved and in weeks 9-13 the egg weight has stabilized above 10 grams / grain. This opinion is supported by the opinion of Pitaloka (2017) which states that the low egg weight is thought to be due to the influence of the age of the quail so that it cannot reach the standard egg weight.

The average egg weight of the research results in the P2 treatment (Addition of 6% maggot flour) is smaller than the average egg weight of the results of the research of Mawaddah *et al*. (2018), in the results of his research showing the average egg weight with the addition of 6.18% maggot flour which is 11.05 grams. However, this result is greater when compared to the results of research by Tarigan (2008), which states that the weight of quail eggs aged 9-18 weeks is 9.17 grams. Quail egg weight ranges from 8 - 10 salt (Yuwanta, 2010).

Egg Mass

Egg mass is closely related to egg weight and egg production and is strongly influenced by ration quality and ration nutrient content. Table 9 shows the average egg mass of the P0, P1, P2, P3, and P4 treatments. The highest average egg mass was found in the P0 treatment (without the addition of maggot flour) which amounted to 8.68 grams and P2 (Addition of 6% maggot flour) which amounted to 8.53 grams and the lowest egg mass was found in the P4 treatment (addition of 12% maggot flour) which amounted to 6.23 grams. The results of the analysis of variance showed that the provision of maggot flour from chicken manure up to 12% level had no significant effect on egg mass. The lowest egg mass was found in treatment P4 (addition of 12% maggot flour) with an average of 6.23 grams. The higher the addition of maggot flour, the lower the egg mass. The decrease in egg mass is caused by low egg production and decreased ration consumption so that it is followed by a decrease in protein consumption. This opinion is supported by the results of research by Mawaddah *et al*. (2018) in the results of his research stated that egg mass is closely related to egg weight and production and is strongly influenced by the content and quality of ration protein. The content of protein and amino acids that are sufficiently balanced in the ration will provide optimal productivity (Mousavi *et. al*., 2013). The average egg mass of the research results in the P2 treatment (addition of 6% maggot flour) which is 8.53 grams is greater when compared to the results of research by Mawaddah *et al*. (2018) which shows that the

mass of eggs given the addition of maggot flour as much as 6.18% which is 7.99 grams.

CONCLUSION

1. Substitution of fish meal with maggot meal from laying hen droppings in the ration of laying quail up to 6% can increase egg production, increase egg weight, increase egg mass, reduce feed consumption and reduce feed conversion.
2. The use of maggot meal from chicken manure up to 6% can be recommended as a source of protein to replace fish meal in the rations of laying quail.

Suggestion

Further research needs to be carried out at the same level to determine the effect of giving maggot flour in the long term on egg production.

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