NUTRITIONAL QUALITY OF DUCK EGGS FEED WITH MAGGOTS (*Hermetia Illucens*)

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Abstract: *This research aims to determine the effect of giving maggot fresh (Hermetia illucens) to duck feed on the nutritional quality (crude protein, gross energy and crude fat) of duck eggs. The design used was a non-factorial Completely Randomized Design (CRD) with 4 treatments and 5 replications. Egg samples are taken from each replication for testing. The feed treatment given to ducks is as follows: (FP0) 100% commercial feed; (FP1) Commercial feed 75% + Fresh maggot 25%; (FP2) Commercial feed 50% + Fresh maggot 50%; (FP3) Commercial feed 25% + Fresh maggot 75%. The results of the study showed that the treatment (addition of maggot fresh to the feed of laying ducks) had a significant effect (P<0.05) on crude protein, gross energy and crude fat in duck eggs. In terms of crude protein parameters, the addition of fresh maggots to duck feed had a lower average crude protein in the eggs produced compared to the 100% commercial feed control treatment. However, for the gross energy content and crude fat contained in duck eggs, the addition of fresh maggots to the duck feed gave higher results compared to the control treatment, namely commercial feed*

INTRODUCTION

Animal husbandry plays an important role in ensuring a sufficient supply of animal protein to meet human needs. According to (Siregar, 2018) livestock plays an important role in meeting people's animal protein needs. Where poultry farming, such as duck meat and duck eggs, is an important part of food production because it is very helpful in meeting human protein needs (Alfisyahrin & Siregar, 2024).

Duck eggs, apart from being known as an important source of animal protein in the human diet, are also an important part of food diversity in Indonesia (Ariani et al., 2018). Consumption of duck eggs in Indonesia tends to increase due to awareness of their high nutritional benefits (Putri & Alamiah, 2019). Duck eggs are an attractive choice for those who care about health and nutrition because they contain lots of protein, vitamins and minerals (Hidayati & Sary, 2019). However, it is important to remember that the species

of duck is not the only factor that influences the nutritional quality of duck eggs, but the feed given to ducks is also very influential.

Good quality feed has a very important role in determining the nutritional quality of the eggs produced (Purwati et al., 2015). Ducks that are given quality feed will produce eggs with optimal nutritional content (Sunarno et al., 2021). Conversely, inadequate feed can lead to bad eggs. Therefore, research on types of feed that can improve the nutritional quality of duck eggs is very important.

One alternative feed that has become the focus of research is maggot (*Hermetia illucens*). Maggots are black fly larvae which are very useful as a feed substitute which can improve the nutritional quality of duck eggs (Fitasari et al., 2021). Maggot larvae come from black flies (*Hermetia illucens*) which are found in many vegetables and fruit, and are also found in palm oil waste (Siregar et al., 2023). Maggot is an attractive option for improving the nutritional quality of duck eggs because of its high protein content, as well as its relatively easy and cheap availability. According to (Siregar et al., 2022) maggots made into flour are also an economical solution for breeders, considering the high price of commercial feed. The addition of maggot that has been made into flour from laying hen manure in the ration of laying quail and mixed with fish meal up to 6% can increase egg production, increase egg weight, increase egg mass, reduce feed consumption and reduce feed conversion (Siregar & Warisman, 2023).

Using maggots as duck feed has several advantages. First, maggots have a high protein content, so they can improve the nutritional quality of the duck eggs produced. Protein is an important nutrient for livestock, and having sufficient amounts of protein can help meet livestock's nutritional needs. Apart from that, maggots are also rich in essential fatty acids and vitamins, which are important for the health and development of livestock. Apart from its high nutritional content, maggots also have advantages in terms of environmentally friendly production. Maggots can be made from cheap and easily available organic materials, such as agricultural waste and organic waste (Bagaskara et al., 2024). Thus, using maggots as duck feed can not only improve the nutritional quality of duck eggs, but can also help reduce organic waste and support sustainable agriculture.

The use of maggots as duck feed has become the subject of interesting research in recent years. (Ajibarata et al., 2023) research stated that fresh maggots can be consumed by laying ducks to increase egg production with reference to giving maggots by 10% and have an effect on egg weight but have no real effect on feed consumption, HDP, shell thickness and shell weight. In research conducted by (Fahmi, 2015), maggot flour has several advantages when used as animal feed. Among them are easy to find and have high protein levels. BSF maggot flour is very good for use as animal feed because it has extraordinary amino acid content, with a protein content of 49.67% and a fat content of 29.65%. When used as animal feed, maggot meal is cheaper than fish meal because it has lots of nutrients (Pesik et al., 2016). (Cahyani et al., 2020) showed that protein tests on maggots found that the protein nutritional content reached 49.67%. Protein and amino acid levels are not much different from those found in other animals.

Previous studies have provided evidence that giving maggots to ducks can improve the nutritional quality of the duck eggs produced. However, further research is still needed to understand in more depth the effect of maggot feeding on the nutritional quality of duck

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eggs. Thus, research on the nutritional quality of duck eggs fed maggot (*Hermetia illucens*) has great relevance and is very important to carry out.

Based on the description above, it is very necessary to carry out research on the nutritional quality of duck eggs fed with maggot (*Hermetia illucens*).

RESEARCH METHODS

This research was carried out at the Panca Budi Development University Laboratory, Building C. The research period was from December 2023 to April 2024.

The materials used are maggot flour and commercial feed. Materials for nutritional analysis are distilled water, H_2SO_4, potassium magnesium sulfate ($MgSO_4$), sodium hydroxide (NaOH), benzoic acid (H_3BO_3), ether, benzene, K_3SO_4, HCl Acetone, and methyl red indicator. The tools used are plastic jars, buckets, knives, and scales. The tools used in nutritional chemistry tests are calorie meter bombs, thermometers, digestion tools, distillation tools, titration tools, and shoxlet tools.

The research method used in the research was a non-factorial Completely Randomized Design (CRD) with 4 treatments and 5 replications. The treatment given is as follows:

FP0: 100% commercial feed (Hi-Pro-Vite Phokpand for Concentrate Feed for Laying Ducks).

FP1: Commercial feed 75% (Hi-Pro-Vite Phokpand for Concentrate Feed for Laying Ducks) + Maggot fresh 25%

FP2: Commercial feed 50% (Hi-Pro-Vite Phokpand for Concentrate Feed for Laying Ducks) + Fresh maggot 50%

FP3: Commercial feed 25% (Hi-Pro-Vite Phokpand for Concentrate Feed for Laying Ducks) + Fresh maggot 75%

RESEARCH IMPLEMENTATION

Duck Egg Sampling

Samples for chemical analysis of the nutritional content of duck eggs were taken randomly based on treatment. The samples that have been taken are immediately analyzed in the laboratory.

Research Parameters

The parameters observed in the analysis of the nutritional content of duck eggs are crude protein, gross energy and crude fat. Proximate testing is carried out in the 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

The parameters observed in this study are the analysis of the nutritional content of crude protein, gross energy and crude fat. Proximate testing was carried out in the laboratory.

1) Analysis of Crude Protein Content

⇒ *Destruction Stage*

At this stage the sample is weighed first, then cooked in a Kjeldahl flask and then added concentrated sulfuric acid (H2SO4) and a catalyst, then deconstructed at 410 ° C continuously until the solution is clear, then let the solution stand and wait until it cools. The results at this stage will then proceed to the distillation stage.

⇒ *Distillation Stage*

After the deconstruction stage, the solution is then put into a distillation flask and then add distilled water and NaOH solution. The solution is then collected using an erlenmayer containing standard acid solution.

⇒ *Titration Stage*

The solution from the distillation stage is titrated using HCl solution until the color of the solution changes color.

2) Gross Energy Analysis

⇒ *The calorific value or gross energy of feedstuffs is measured using a bomb calorimeter by joining the electrode tip to the burner wire.*

⇒ *The weighed sample is then put into the combustion bowl and then placed on the electrode support. Attach the bomb cap with the container until it is tightly attached and tight.*

⇒ *The bomb vessel was filled with oxygen gas for 1 minute by turning on the Fill menu on the device monitor.*

⇒ *The bomb vessel is inserted into a water vessel that has been filled with distilled water as much as 2 liters first. The water vessel was then put into the jacket container and tightly closed using the bomb bucket.*

⇒ *The electrode cable is then connected to a 23 V power supply and press the Start button. Wait until the stirring process is complete or approximately 5 minutes. At the 6th minute, the temperature was recorded with the code t1.*

⇒ *The power supply button is turned on so that combustion occurs in the bomb. Observe the temperature change until the temperature stabilizes again and then record the temperature again and coded as t2.*

⇒ *Crude protein content is calculated using the formula:*

Description: VA = milliliter titration for sample
VB = military titration for blank
N = HCl concentration used
14.007 = Atomic weight of nitrogen
6.26 = Conversion factor

3) Crude Fat Analysis (LK)

Crude fat consists of fat and pigment. Crude fat analysis can be done by means of the Soxhlet method and generally uses ether compounds as solvents, therefore crude fat analysis is also referred to as ether extract. The sample will be soaked and boiled using ether solution,

$$\text{LK}\,(\%) = \frac{A-B}{C} \times 100$$

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the solution will evaporate and leave fat on the flask wall. The formula is:

Description: A = Weight of flask and fat after oven
B = Weight of empty flask after oven
C = Weight of sample

RESULTS AND DISCUSSION

The recapitulation of poultry basal diet (using fish meal and earthworm meal according to the treatment level on crude protein, crude fiber and gross energy in all parameters is presented in Table 1.

Table 1. Recapitulation of the average value of giving maggot fresh (Hermetia illucens) to duck feed on the nutritional quality (crude protein, gross energy and crude fat) of duck eggs.

Treatment	*Parameters*		
	Crude Protein (%)	Crude Fat (%)	Gross Energy (cal/100g)
FP0	13,80^{tn}	10,08^{a}	1096^{a}
FP1	13,06^{tn}	10,55^{b}	1152^{b}
FP2	12,89^{tn}	11,10^{d}	1807^{d}
FP3	12,60^{tn}	10,81^{c}	1244^{c}

Notes: Different superscripts in the same column indicate significantly different results ($p<0.05$).
tn = not significantly different

Table 1 shows the results of the analysis of crude protein content in duck eggs given a mixture of fresh maggots according to the level of treatment.

The results of analysis of variance in crude protein levels showed no significant differences (P>0.05) between all research treatments. Average crude protein content of FP0, FP1, FP2, and FP3 respectively: 13,80%; 13,06%; 12,89%; and 12,60%.

According to research conducted by **(Winarno & Koswara, 2002)**, the protein content in duck egg yolk reaches 13.10%. The high or low protein content in duck eggs is influenced by the nutrients available in the ration. (Yuwanta, 2010) stated that various factors such as age, nutritional composition in the ration, genetic factors, environmental temperature, and rearing management have an influence on the proportion and chemical composition of eggs.

According to (Wahyu, 2004), protein has a crucial role in promoting the growth of poultry tissue, including the formation of components such as meat, eggs, skin and feathers. Apart from its role in forming antibodies, regulating nutrition, and providing energy, protein is also responsible for maintaining the balance of body fluids, forming essential body bonds, and maintaining body neutrality, as explained by (Almatsier, 2001).

The addition of fresh maggots can reduce the amount of commercial feed used in basic poultry feed. According to (Ibrahim, 2006), including fresh maggots in animal feed as a source of animal protein is considered very effective. It should be understood that the amount of protein required for livestock growth and production must be considered

carefully when preparing rations, as stated by (Muhammad, 2023).

The results showed that the average crude fat content in duck eggs at 28 weeks of age varied between 10.08% and 11.10% for each treatment given. Analysis of variance showed that the addition of fresh maggots to commercial feed significantly influenced the crude fat content in duck eggs (P<0.05). The higher the level of use of fresh maggot added to the feed, the higher the crude fat content in duck eggs(Zerehdaran et al., 2004) stated that feed composition has a significant impact on fat accumulation in the animal's body. The fat content in eggs can be influenced by the fat content in the feed, as stated by **(Bell & Weaver, 2001)**. (Witari et al., 2014) explained that fat in feed is digested by pancreatic enzymes and emulsified by bile salts in the intestine, forming micelles which are then absorbed by the body as an energy source and basic material for the formation of substances such as cholesterol which plays a role in egg formation.

Based on the results of analysis of variance, it showed that the addition of fresh maggots to duck feed made a significant difference (P<0.05) to the gross energy content of basal feed. The average gross energy content of FP0, FP1, FP2, and FP3 respectively is 1,096 kcal/kg; 1,152 kcal/kg; 1,807 kcal/kg; and 1,244 kcal/kg.

The gross energy in question does not come directly from food, but is produced from the oxidation process of food such as carbohydrates, fats and proteins during metabolism. The term “gross energy” refers to the energy consumed by animals from feed; some of this energy is excreted through feces and urine, while the other part is used to support metabolic processes (Sumadi, 2017).

CONCLUSION

The addition of fresh maggots given to laying ducks' feed by up to 50% can increase the crude fat and gross energy content of duck eggs, but the crude protein content in eggs shows no significant difference between feeds added with fresh maggots compared to feeds given commercial feed of 100%.

SUGGESTION

The use of up to 50% fresh maggot can be added to the feed of laying ducks which produces crude protein that is no different from commercial feed and crude fat and higher gross energy.

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