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EVALUATION OF NUTRITIONAL EARTH WORMS (LUMBRICUS RUBELLUS) AS A SUBSTITUTE FOR FISH MEAL IN BASAL FEEDING FOR POULTRY

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Abstract: *The aim of this research is to improve the nutritional quality (crude protein, gross energy and crude fat) in basal feed for poultry by providing earthworm meal as a substitute for fish meal. The hypothesis of this research is that the use of earthworm meal as a substitute for fish meal can increase the nutritional value (crude protein, gross energy and crude fat) in basal feed for cnpoultry. The materials used in the research were earthworm flour, fine corn bran, rice bran, DDGS (Distillers Dried Grains with Solubles), soybean meal, fish meal, coconut oil, premix and salt. Materials for chemical feed nutrition tests are H2SO4, NaOH, Acetone, Boric acid HCl and methyl red indicator. The research method used in the research was a non-factorial Completely Randomized Design (CRD) with 5 treatments and 4 replications. The treatments given were as follows: P0 (Basal feed for poultry (using 10% fish meal without earthworm meal) / Control); P1 (Basal feed for poultry (using 7.5% fish meal and 2.5% earthworm meal)); P2 (Basal feed for poultry (using 5% fish meal and 5% earthworm meal)); P3 (Basal feed for poultry (using 2.5% fish meal and 7.5% earthworm meal); P4 (Basal feed for poultry (using 10% earthworm meal without fish meal)). The parameters observed include analysis of the nutritional content of crude protein, gross energy and crude fat. Proximate testing is carried out in the laboratory. The conclusion of this research is that giving earthworm meal as a substitute for fish meal in basal feed for poultry up to a level of 10% can increase crude protein, gross energy and crude fat.*

INTRODUCTION

With the rapid growth of the global population and the increasing demand for food resources, the livestock sector plays an important role in ensuring an adequate supply of animal protein to meet human needs. Animal husbandry is an important part of meeting people's animal protein needs (Siregar, 2018).

Poultry farming, such as chickens and ducks, is one of the important sectors in food production that contributes greatly to meeting protein needs. However, the sustainability

of animal feed production is becoming an increasingly pressing issue, especially when it comes to protein sources in animal feed. Fishmeal, as the main protein source in poultry feed, has played an important role in supporting the growth and productivity of farm animals. Although fishmeal is rich in essential nutrients, its use is linked to a number of environmental and sustainability concerns. Overfishing and processing of fish into meal have led to a decline in marine fish stocks and negative impacts on aquatic ecosystems. Therefore, the search for sustainable and more environmentally friendly alternatives is a must.

One interesting alternative is earthworms (*Lumbricus rubellus*). Earthworms (*Lumbricus rubellus*) are soil animals that have many benefits. Earthworms (Lumbricus rubellus) are usually used as a source of protein-rich feed needed for livestock such as poultry, fish and shrimp (Febrita, 2015). Earthworms (*Lumbricus rubellus*) contain protein, which is 63.65% of dry matter (BK) (Damayanti et al., 2008), protein by 60-70%, crude fat 7%, calcium 0.55%, phosphorus 1%, and crude fiber 1.08% (Aziz, 2015). Earthworms are known to have potential as a source of protein in poultry feed. They can reproduce rapidly, process organic waste into digestible nutrients, as well as provide comprehensive nutritional value to farm animals. However, despite their promising potential, the use of earthworms as a substitute for fishmeal in animal feed still needs to be further evaluated in terms of nutritional aspects, livestock growth, and environmental impacts.

Therefore, research that leads to the nutritional evaluation of earthworms as a substitute for fishmeal in poultry basal feed needs to be conducted. Such research will provide greater insight into the potential of earthworms as a sustainable alternative protein source in an effort to maintain feed availability and environmental sustainability. By understanding the nutritional value and potential impact of using earthworms in poultry feed, we can develop more sustainable and environmentally friendly solutions to meet the protein needs of livestock and humans in the future.

Based on the description above, researchers want to conduct research on nutritional evaluation of earthworms as a substitute for fishmeal in poultry basal feed.

RESEARCH METHODS

This research has been carried out at the Basic Sciences Laboratory of Universitas Pembangunan Panca Budi from April to June 2023.

The materials used in the study were earthworm meal, fine corn bran, rice bran, DDGS (Distillers Dried Grains with Solubles), soybean meal, fish meal, coconut oil, premix and salt. Materials for chemical test of feed nutrition are H2SO4, NaOH, Acetone, HCl boric acid and methyl red indicator. The tools used are plastic basins, buckets, knives, scales, and stationery. The tools used in the nutritional chemistry test are Bom calorie meter, thermometer, deconstruction tool, distillation tool, titration tool, and shoxletation tool. The research method used in the study was a non-factorial Completely Randomized Design (CRD) with 5 treatments and 4 replicates. The treatments given are as follows:

P0 : Poultry basal feed (using 10% fish meal without earthworm meal) / Control.
P1 : Poultry basal diet (using 7.5% fish meal and 2.5% earthworm meal).
P2 : Poultry basal diet (using 5% fish meal and 5% earthworm meal).
P3 : Poultry basal diet (using 2.5% fish meal and 7.5% earthworm meal).

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P4 : Poultry basal diet (using 10% earthworm meal without fish meal).

Methode

Research Implementation

1. Preparation of earthworm meal, carried out with the following process:
   - The earthworms obtained were first cleaned of any foreign objects attached to them.
   - Earthworms are then dried in the sun until dry
   - Earthworms that have been dried are mashed until crushed for a more optimal pulverization process
   - Smoothed again using a grinder machine to grind the sample
   - Earthworm flour is ready to be used as feed
2. Mixing of feed ingredients

Earthworm meal that is ready to use is mixed with the basal feed that will be used in the study until homogeneous. The feed ingredients used are fine corn bran, fine bran, fish meal, earthworm meal, soybean meal, coconut oil, premix and salt. The composition of the research treatment feed is detailed in table 1.

Table 1. Feed Formulation Treatment

No	Material	Treatment				
		P0	**P1**	**P2**	**P3**	**P4**
1	Fine Corn Bran	50	50	50	50	50
2	DDGS	15	15	15	15	15
3	Rice Bran	6	6	6	6	6
4	Soy Bean Meal	15	15	15	15	15
5	Fish T.	10	7,5	5	2,5	0
7	Earthworm Meal	0	2,5	5	7,5	10
8	Coconut Oil	2	2	2	2	2
9	Premix	1	1	1	1	1
10	Salt	1	1	1	1	1
	Total	**100**	**100**	**100**	**100**	**100**

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:

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

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

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 2.

Table 2. Recapitulation of mean values of poultry basal diet (using fish meal and earthworm meal according to treatment levels on crude protein, crude fiber and gross energy.

Treatment	Parameters		
	Crude Protein (%)	Crude Fiber (%)	Gross Energy (cal/100g)
P0	21,30^{A}	6,99^{tn}	3081,45^{tn}
P1	21,76^{B}	6,91^{tn}	3105,28^{tn}
P2	22,16^{C}	6,88^{tn}	3118,10^{tn}
P3	22,60^{D}	6,81^{tn}	3134,43^{tn}
P4	22,94^{E}	6,84^{tn}	3147,25^{tn}

Notes: Different superscripts in the same column indicate significantly different results ($p<0.01$).
tn = not significantly different

Crude Protein

All nitrogen-containing substances are called crude proteins (Andriani et al., 2022). Table 2 shows the results of crude protein content analysis in poultry basal feed given with a mixture of worm meal and fish meal according to the treatment level.

The results of the analysis of variance of crude protein content showed a very significant difference ($P < 0.01$) from the basal feed of poultry (using fish meal and earthworm meal according to the treatment level of crude protein increased until the treatment level (P4), namely basal feed of poultry (using 10% earthworm meal without fish meal).

The average crude protein content of P0, P1, P2, P3 and P4 were: 21.30%; 21.76%; 22.16%; 22.60% and 22.94%. Worm meal can reduce the amount of concentrate or fishmeal used in poultry basal diets. Fishmeal, as a source of animal protein, is very efficient as a feed ingredient, according to Ibrahim (2006). The amount of protein required for growth and production of livestock must be known when preparing the ration (Nazilah 2004).

Furthermore, Wahju (2004) states that protein plays an important role in the growth of poultry tissues, including the formation of meat, skin, and feathers. In addition to functioning as an antibody maker, nutrient regulator, and energy source, protein is also responsible for water balance, formation of essential body bonds, and maintaining body neutrality (Almatsier, 2003).

Crude Fiber

Based on the results of the analysis of variance showed that the addition of earthworm meal up to the level of 10% cross-subsidized with fishmeal in the basal feed of birds did not give a significant difference ($P>0.05$) on the crude fiber content of the ration. The average crude fiber content of P0, P1, P2, P3 and P4 were 6,99%; 6,91%; 6,88%; 6,81% and 6,84%, respectively. Crude fiber consists of cellulose, hemicellulose and lignin, most of which cannot be digested by birds (Wahju, 2004). The results of the study on the crude

fiber content of basal feed supplemented with earthworm meal and subsidized fish meal according to the level of each treatment starting from treatment P0, P1, P2, P3 and P4 can be seen in Table 2.

The value of crude fiber in the basal feed preparation of each treatment, which is based on the results of calculations before analysis, tends to be the same. As a result, the results of the analysis of crude fiber content in each treatment were not significantly different. According to the results of the study, the crude fiber content of poultry basal diets is still low, less than 7% of the ration, and basal diets supplemented with up to 10% earthworm meal cross-subsidized with fishmeal did not increase the crude fiber content.

According to SNI (2008), the level of crude fiber in feed greatly influences poultry performance and growth; laying quails require up to 7% for the starter, grower, and layer phases, and laying quails can tolerate up to 7%. Crude fiber is important for stimulating digestive tract movement, and a lack of fiber can cause digestive problems. It is difficult for poultry to digest crude fiber as it is part of the plant cell wall and does not contain many nutrients, but crude fiber must be present in the feed as it has physiological and nutritional functions.

Gross Energy

The energy content does not come from food, but comes from the oxidation of food (carbohydrates, fats and proteins) during the metabolic process. Gross energy, also called gross energy, is the energy consumed by livestock from feed; some of this gross energy is wasted in feces and urine, and some is used as metabolic energy (Sumadi, 2017).

Based on the results of the analysis of variance showed that the addition of earthworm meal up to the level of 10% replacement of fishmeal in feed was not significantly different ($P>0.05$) on the gross energy content of basal feed. The average gross energy content of P0, P1, P2, P3 and P4 were 3081.45 kcal/kg; 3105.28 kcal/kg; 3118.10 kcal/kg; 3134.43 kcal/kg and 3147.25 kcal/kg, respectively.

CONCLUSION

Feeding earthworm meal as a substitute for fish meal in poultry basal diet up to 10% level can increase crude protein, gross energy and crude fat.

Suggestion

To obtain better results, it is recommended that future researchers conduct further research from the best treatment in this study on its application to livestock to find out how the growth and digestibility response will get the best results so that it can be recommended to the community.

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