Potential Of Earthworm (Lumbricus Rubellus) Cultivated On Cow Dung Organic Wastes As An Alternative For Ingredients Of Cyprinus Carpio

Achmad Mufti, Yenny Risjani, Arning W. Ekawati

Abstract : Fish feeds have been relying on protein sources from fish meal which are getting more expensive over time, therefore an alternative source of protein is needed as a source of fish meal protein. Earthworm (Lumbricus rubellus) is one alternative that meets the requirements as a source of protein because its nutrient content is relatively high, besides that earthworms are also quite easy to be cultivated so that farmers can produce it themselves. The purpose of this study was to determine the results of differences in the types of media for cultivating earthworms on growth and nutrient content of earthworms and to determine the effect of earthworm flour sustution on fish meal as the main protein source in common carp feed formulations. Cultivation of earthworms on different organic wastes, namely a combination of mushroom log and cow dung with media treatment doses of mushroom log worm 100%, mushroom log 75% and cow dung 25%, mushroom log 50% and 50% cow dung, 25% log mushroom and 75% cow dung, and 100% sai dung. The best results from cultivation on different organic wastes will be used as a substitute material for substituting fish meal as a source of animal protein in carp. Substitution of earthworm flour treatment against fish meal with treatments A (0%), B (25%), C (50%), D (75%) and E (100%). The main parameters observed included survival rate, specific growth rate, feed conversion ratio, and protein efficiency ratio,. The results of the cultivation of earthworms with the best media, 100% cow dung, with an average biomass weight of 1,220.53 g with nutritional content of 53,11% protein, 10,22% fat, 10,1% ash and carbohydrates 12,25%. The results of the showed that the use of earthworm meal substitution in feed did not affect the survival of carp, but had a very significant effect on the specific growth rate (SGR) of 56.67%; 2.49 BB / day; 44% for feed conversion ratio (FCR)1,94, 52% and for protein efficiency ratio (PER) 1.89; 54.14% .

Index Terms: Lumbricus rubella, earthworms, cow dung, common carp.

1. INTRODUCTION

COmmon carp is one of the aquaculture commodities that is quite in demand by fish farmers in Indonesia. Common carp is a type of consumption fish or can be freshwater ornamental fish. Many factors affect growth, including the quality and quantity of feed given (1). The feed given should contain ingredients such as protein, carbohydrates, fats, vitamins and minerals. During this time, the source of protein feed products for fish is very dependent on fish meal which is relatively quite expensive and for the availability of it, the majority must import first. Data obtained from the Ministry of Maritime Affairs and Fisheries, Indonesian fish meal imports reached 4.1 million tons during January to September 2016 (2). Indonesia allocates approximately US $ 200 million per year to import fish flour and oil, therefore another alternative source of protein is needed to replace fish meal (3). Earthworms can be used as an alternative to potential fish feed ingredients as a substitute for feed ingredients that have been using fish meal as a source of animal protein. The quality of earthworm protein is quite high at 64-76%, so it has a chance as a substitute for feed ingredients so it is not too dependent on fish meal. In addition to the relatively high protein content of earthworms it also contains quite low fat around 7-10% and other contents including 0.55% calcium, 1% phosphorus and 1.08% crude fiber and anti-microbial substances. Earthworms need media that contain organic matter because organic matter is essential for growth. The spread of earthworms is influenced by the condition of organic matter contained in the media where he lives because it is able to influence the development and growth of earthworms (4). Materials that can be used as a medium for earthworm cultivation can be taken from organic wastes that can still be used, among others, cow dung and log mushrooms (5). Cow manure can be used for earthworm cultivation media because it has organic material that is suitable for earthworm culture media. Cow dung also has a protein content of 5-10% and low nitrogen so that it is preferred by earthworms compared to other livestock manure (6). Other organic material is log fungus which is a mixture of several organic materials including wood sawdust, wood dust used by albasiah or sengon. Fungal log waste contains 9.15% protein, 12.26% water, 32.35% ash, 1.45% calcium, 0.39% phosphorus, 0.40% fat, and 0.47% salt (7). Utilization of organic waste that is used as a medium for earthworm cultivation is expected to be an alternative as a medium for cultivating earthworms which has been used by farmers of earthworms as well as is expected to affect the nutritional content of earthworms, so that it can be mass produced and then can be used as an alternative to flour fish which has been used as a source of protein in the manufacture of fish feed.

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2 MATERIAL AND METHOD

2.1 Research Sampel

The stages of this research are earthworm cultivation using different growth and breeding media, including log mushrooms and cow dung obtained from cattle farms and mushroom cultivators in Turen, Malang. After conducting earthworm cultivation, then the results of the earthworm itself will be used as a source of protein feed for carp which is used as pellet feed. The carp itself was obtained from UPBAT Punten, Batu. During the maintenance of this fish, each aquarium will be given a density of 10 fish.

2.2 Preparation of Earthworm Culture Containers (L. rubellus)

The process of cultivating earthworm growth is as follows:

1. Earthworm maintenance container used in this study is a box-shaped plastic tub measuring 40 cm x 30 cm x 15 cm as many as 15 pieces
2. The media is put into each container as high as 5 cm then moistened with water
3. These earthworm maintenance containers are stored in a place that is not exposed to direct sunlight and must be in humid conditions.
4. The media is filled with 1 kg of earthworms and then maintained for 14 days and observed the condition of the media and growth of earthworms.
5. After a maintenance period of approximately 14 days, earthworms which are already abundant in containers can be harvested, then the earthworms obtained are cleaned from the rest of the maintenance media, after that they can be stored in a freezer for further use as the main source of food protein common carp in the form of pellets with feed formulations.

2.3 Making Earthworm Flour

The work procedure in making earthworms that will be carried out is as follows:
1. Washing.
2. Boiling.
3. Cutting or cutting.
4. Drying.
5. Milling or Milling

2.4 Fish Preparation

The work procedures in preparing fish in this study are as follows:
1. Newly arrived fish are adapted first for 1 week to be able to adjust to the environment.
2. Prepared fish that has been adapted.
3. Prepared a research aquarium that has been given aeration for 1 full day or about 24 hours.
4. Put the fish into the aquarium with 10 stocking densely packed in each aquarium.

Fish that have been put into the aquarium are treated

2.5 Experiment Feed Formulation

TABLE 1
Experiment Feed Formulation

Ingredients	Treatment				
	A (100 : 0)	B (75 : 25)	C (50 : 50)	D (25 : 75)	E (0 : 100)
Fish flour	27,92	20,94	13,96	6,98	0,00
Earthworm flour	0,00	6,29	12,59	18,88	25,17
Soy flour	47,28	47,28	47,28	47,28	47,28
Bran flour	7,18	7,18	7,18	7,18	7,18
Tapioca flour	13,87	11,94	10,01	8,09	6,16
Vitamins and Minerals	2,00	2,00	2,00	2,00	2,00
Cr2O3	0,50	0,50	0,50	0,50	0,50
CMC	1,26	3,87	6,48	9,09	11,70
Ingredients Total (gram)	100,00	100,00	100,00	100,00	100,00
Protein (%)	31,18	31,18	31,17	31,17	31,16
Fat (%)	11,11	11,65	12,19	12,73	13,27
Crude Fiber (%)	9,00	8,34	7,68	7,02	6,36
BETN (%)	35,47	33,72	31,98	30,23	28,49
DE (%)	287,78	287,78	287,78	287,78	287,78
GE (%)	462,46	457,26	452,06	446,86	441,66
Energy balance :	8,72	8,72	8,72	8,72	8,72

2.6 Implementation of Biological Tests

Common carp (Cyprinus carpio) acclimatized in an experimental container for 7 days on the environment and feed then the day before the study of fish were fasted and weighed to determine the initial weight. Fish stocked with a density of 10 fish per aquarium

2.7 Proximate Analysis of Earthworms (L. rubellus)

Proximate analysis consists of water content, crude protein content, crude fat content, ash content and crude fiber using the AOAC method

2.8 Carp Test Parameters (C. Carpio L.)

2.8.1 SR,SGR, FCR dan PER

The parameter that has been done in this research is the observation of the growth rate of carp. This observation was carried out to see differences in length and body weight of fish according to the treatment of earthworm flour as an alternative to fish meal for 30 days of maintenance
a. Survival / Survival Rate (SR) (8).
b. Specific Growth Rate (SGR) (8).
c. Feed Conversion Rate (FCR)(8).
d. Protein Efficiency Ratio (PER) (9).

2.9 Data Analysis

The data collected during subsequent studies were analyzed statistically using diversity analysis (ANOVA), according to the design used, which is a completely randomized design (CRD).

3 RESULTS AND DISCUSSION

3.1 Results of Proximate Analysis of Earthworm Flour

Based on the results of proximate tests conducted obtained the results of testing the nutritional content of earthworm flour are listed in Table 2.

TABLE 2.
Proximate Analysis of Earthworm Flour in Different Media.

	Protein	Lemak	Air	Abu
Log Jamur 100%	48,83	10,23	15,59	10,62
LJ 75% KS 25%	50,64	11,37	14,91	10,07
LJ 50% KS 50%	51,14	10,19	14,17	10,07
LJ 25% KS 75%	51,80	10,58	15,12	11,13
Kotoran Sapi 100%	53,11	10,22	14,31	10,1

Table 2 can be seen that the nutrient content of the best earthworm flour is dominated by earthworm flour resulting from cultivation in cow dung, especially in the highest protein content compared to earthworm flour produced from earthworms cultivated in other cultivation media. This can be caused because the earthworms that are cultivated in cow dung get the best nutritional intake compared to other media. The nutrient content contained in earthworms is influenced by the media and feed used during the cultivation process, if the media and feed used during the cultivation process are good, then the nutrient content contained in the earthworm's body will be good too. This earthworm will reduce and convert nutrients contained in the media by 50-70% for the process of earthworm growth(4)

3.2 Results of SR, SGR, FCR, PER

TABLE 3
Results of SR, SGR, FCR, PER

Parameter	Treatments				
	A	B	C	D	E
SR (%)	100 ± 0,00^{a}	100 ± 0,00^{a}	100 ± 0,00^{a}	100 ± 0,00^{a}	100 ± 0,00^{a}
SGR (%)	1,62 ± 0,02^{a}	2,06 ± 0,04^{d}	2,40 ± 0,03^{e}	2,77 ± 0,04^{c}	1,93 ± 0,06^{b}
FCR	2,68 ± 0,10^{d}	2,00 ± 0,03^{b}	1,69 ± 0,04^{a}	1,46 ± 0,05^{c}	2,26 ± 0,07^{d}
PER	1,13 ± 0,04^{a}	1,51 ± 0,02^{c}	1,80 ± 0,04^{d}	2,08 ± 0,07^{b}	1,34 ± 0,4^{a}

Note: The same notation shows no difference, while different notation shows the difference between treatments with a 95% confidence interval

During the maintenance period of carp using treatment with feed that was given substitution of earthworm flour treatment on fish meal did not have an effect that resulted in death in fish so it can be concluded that the treatment of the feed did not have a negative effect during the maintenance period. Besides that, the water quality which is well controlled and in accordance with the optimal conditions also causes the survival rate of the salama fish as well as the maintenance period. (10), states that the factors that can affect the level of life and survival of an organism are biotic and abiotic factors. Biotic factors include competitors, population density, age and ability of organisms to the environment while abiotic factors such as temperature, dissolved oxygen, and pH

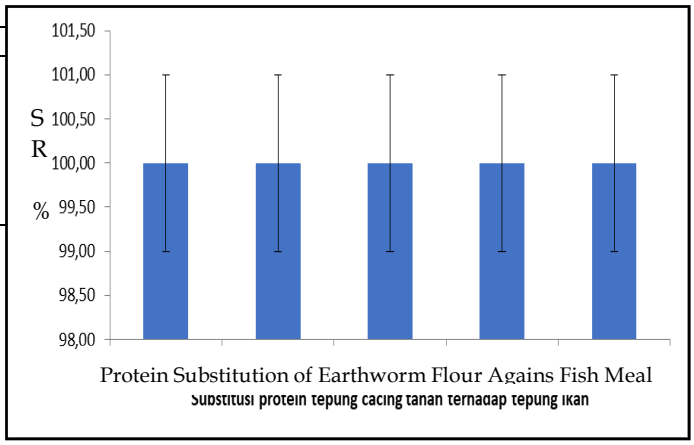

Fig 1.. *Graph of average survival of carp during the maintenance period*

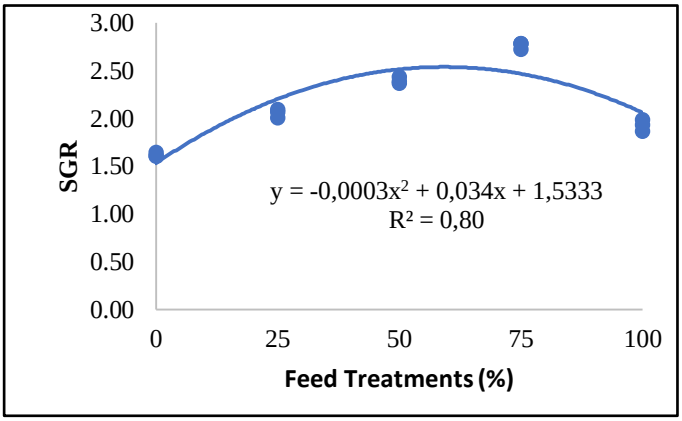

***Fig 2**. Relationship between earthworm meal substitution to fish meal in feed formula on specific growth rate of carp (Cyprinus carpio L.)*

One of the growth of fish is influenced by the feed given to fish during the cultivation process. A good feed and in accordance with the needs of fish will produce good fish growth during the cultivation process. This study compared the use of earthworm flour substitutions to fish meal which resulted in a significant growth rate in each treatment and the best was in treatment D, namely the use of 75% of earthworm substitutions for fish meal.

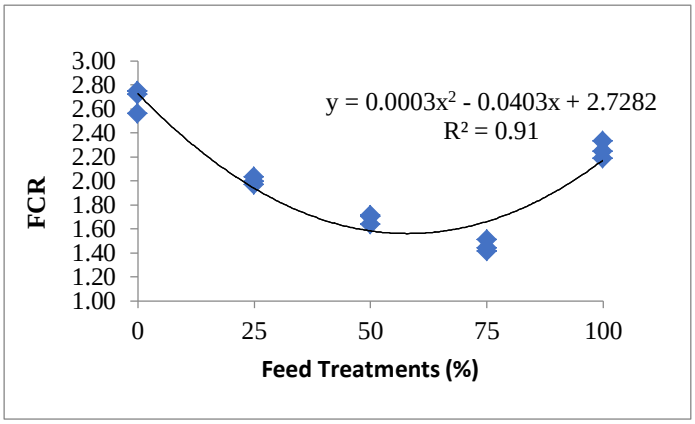

***Fig 3.** Relationship between earthworm meal substitution to fish meal in feed formula to feed conversion ratio of carp (Cyprinus carpio L.).*

Cr2O3 in feed can be absorbed by the digestive tract and can then be accumulated by the body. Chromium is part of a chromodulin compound that can activate insulin receptors, and will further make insulin work to transfer glucose and amino acids into cells (11). This means that the presence of Cr2O3 in the feed will be used as an indicator of the digestible feed in the body of the fish. The better quality of feed used in the aquaculture process will result in lower use of feed efficiency values, meaning that in the aquaculture process we do not need too much feed in terms of quantity or quantity to produce growth or weight of good fish.

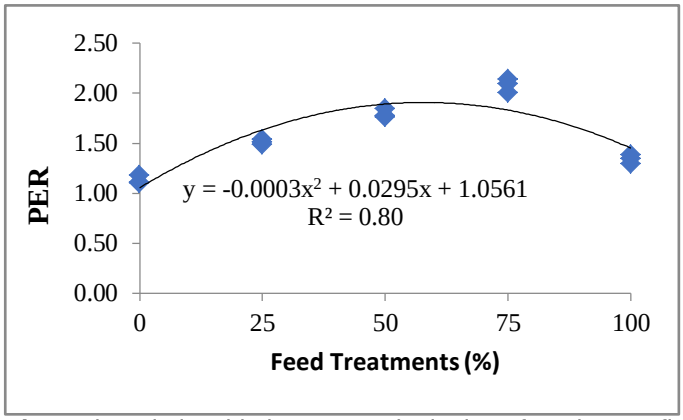

***Fig 4.** The relationship between substitution of earthworm flour to fish meal in feed formula to the ratio of efficiency of carp protein (Cyprinus carpio L.)*

The digestion process of feed protein begins in the fish's stomach. Protein in the stomach will undergo a denaturation process by the action of HCl and hydrolyzed by the enzyme pepsin, so that the protein is turned into a peptide. Furthermore, the digestive process in the intestine, peptides will undergo hydrolysis with the enzyme carboxypeptidase, trypsin, chimotripsin and elastase as the catalyst. Furthermore, this oligopeptide will be hydrolyzed with the enzyme peptidase into a form of tripeptide, dipeptide and amino acids (12)

4 CONCLUSION

The use of earthworm flour substitution on fish meal affected the specific growth rate of 56,67%; 2,49 BB / day; 44% for a feed conversion ratio of 1,94, 44% for a protein efficiency ratio of 1,89

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