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EFFECT OF FERMENTED LEMNA SP. MEAL IN ARTIFICIAL FEED AGAINST THE GROWTH RATE OF GIANT GOURAMI (OSPHRONEMUS GOURAMY) at Nursery Phase

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ABSTRACT

The purpose of this study was to determine the percentage of the balance of *Lemna* sp. meal from fermentation results in an artificial feed that produces the best growth of giant gourami in the nursery phase IV. The study was conducted in April to June 2018 in the Laboratory of Aquaculture Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. The method used in this study is an experimental method with a completely randomized design (CRD) consisting of 4 treatments and 3 repetition, which is by the addition of Lemna sp. flour from fermentation results in a feed with successive percentages of 30%, 40%, 50%, 60%. The parameters observed were changes in the nutritional value of Lemna sp. after fermentation, growth rate, feed conversion ratio, survival rate, and water quality. Growth rate data and feed conversion ratio were analyzed using analysis of variance while the changes in nutritional value of *Lemna* sp. were analyzed descriptively. The results of changes in nutritional value of feed showed an increase in crude protein from 13.22% to 19.33% and a decrease in crude fiber from 20.08% to 15.38%. A balance of *Lemna* sp. flour from fermentation results and commercial feed of artificial feed in Giant gourami that showed a fairly best daily growth rate at 30% *Lemna* sp. flour from fermentation and 70% commercial feed which were 1.44%, with a consecutive feed conversion ratio of 1.82 and survival rate 86.67%.

Keywords: Giant Gourami Fish, Daily growth rate, Lemna sp. from Fermentation Results.

1. INTRODUCTION

Giant gourami is a type of freshwater that is widely cultivated by farmers, has high economic value, good taste of meat, and stable selling price (Zakaria 2008)[1]. Market demand for *Giant gouram*i increases every year. However, current production from Giant gourami cultivation has not been able to meet market needs. Base on statistical data from Directorate of aquaculture production of Giant gourami in 2016, namely 113.407 tons from the target of 116.300 tons.

Slow growth is one of the obstacles in the cultivation of gourami. This is due to the lack of achievement of the balance of feed nutrients needed by gourami (Stephani *et al* 2014). However, artificial feed use tends to cost relatively high. Therefore an alternative raw material is needed as a solution to reduce the relatively expensive feed costs. According to Alamsyah *et al* (2009) based on their eating habits, gourami is omnivorous fish that tend to be herbivores. Therefore, gourami can consume food sources derived from plants.

Lemna sp. is a water plant from the duckweed group which was found float above the water. Lemna sp. more commonly known as a weed in waters that tends to be controlled, spreading widely in the tropics (Said 2006). *Lemna* sp. is a potential feed ingredient with high protein content. Research on the potential of Lemna sp. as a fish feed ingredient has been widely carried out, the crude protein content of Lemna sp. is 25.22% (Winarti *et al* 2017).

The disadvantage of lemna as a feed is the high crude fiber content. The crude fiber content of Lemna sp. is 20.08%. One effort to reduce crude fiber in feed ingredients is to use the fermentation method. According to Johan W. von Mollendorff (2008) fermentation is a process of biochemical changes from the substrate due to microbial activity and enzymes released by these microbes. In the fermentation process, there is an increase in nutrition and the quality of feed ingredients.

Addition of *Lemna* sp. flour fermented in an artificial feed to a certain extent if it exceeds will cause a decrease in protein value and increase crude fiber content. Information on the addition of Lemna sp fermented flour on feed carp nursery phase is still unknown. The purpose of this study was to determine the percentage of addition of Lemna sp flour. fermented products on artificial feed which results in the optimal growth of gourami in the nursery phase IV.

2. METHODS

2.1. Material and Tool of Research

This study will be carried out in four buildings Wet Laboratory Faculty of Fisheries and Marine Sciences, University of Padjadjaran. Content analysis of Lemna sp. conducted at the Nutrition Laboratory of the Faculty of Animal Husbandry, Padjadjaran University. The research was conducted from April to June 2018.

The method used in this study is an experimental method with Completely Randomized Design (CRD). The treatments used in this study were 4 treatments and 3 replications, with the following treatments:

Treatment A: Artificial feed 70% and *Lemna* sp. 30% fermented
Treatment B: Artificial feed 60% and *Lemna* sp. 40% fermented
Treatment C: Artificial feed 50% and *Lemna* sp. 50% fermented
Treatment D: Artificial feed 40% and *Lemna* sp. 60% fermented

The parameters observed were changes in the nutritional value of *Lemna* sp. after fermentation, growth rate, feed conversion ratio, survival rate, and water quality. Data on growth rate and feed conversion ratio were analyzed using variance analysis while changes in the nutritional value of Lemna sp, were analyzed descriptively.

3. RESULTS AND DISCUSSION

3.1.1. Changes in Nutritional Value of *Lemna* sp.

According to Winarno (1997) Enzymes produced in the fermentation process are beneficial, so they can improve nutritional value and increase growth and digestibility of feed nutrients. The proximate test results for Lemna sp before and after fermentation are shown in Table 1.

Table 1. Fermented *Lemna* sp.

Parameter	Bahan		Changes Nutritional Value
	Lemna sp. (*)	*Lemna* sp. Fermented (**)	
Water Content (%)	91.32	8.56	90.63
Crude Fiber (%)	20.08	15.38	23.41
Crude Protein (%)	13.22	19.33	46.22
Crude Fat (%)	2.98	2.99	0.34
BETN (%)	52.30	41.34	20.96

Description: Proximate Composition of Analysed *Lemna* sp. in the Nutrition Laboratory of the Faculty of Animal Husbandry UNPAD

According to Table 1, Lemna sp fermented using Aquasimbad probiotics experienced an increase in nutritional value, namely changes in water content 90.63%, decrease in crude fiber 23.41%, increase in crude protein 46.22% and crude fat 0.34% and the decrease in BETN 20.96%. These results show that fermentation on Lemna sp. can increase the nutritional value and minimize anti-nutrients substance contained in green feed ingredients.

Based on the proximate test results that Lemna fermented using Aquasimba probiotics and incubated for 7 days causing a significant decrease in water content, from 91.32% to 8.56%. The decrease is caused by the drying process after fermentation. The purpose of this drying is to facilitate during the process of sifting and during the process of mixing feed ingredients. The high water content in fish feed has an impact on the low feed response and growth rate. The maximum limit of the water content in the feed of gourami that is equal to 12% (Prihartono 2004).

Changes in nutritional value can be seen in crude fiber content which has decreased from 20.08% to 15.38%. This decrease in crude fiber content is caused by the role of Lactobacillus sp bacteria that produce cellulase enzymes which can break down lignin produced from plant cell walls into glucose (Sumarsih et al 2012). Based on Zidni (2016) a decrease in crude fiber content of Lemna sp caused by changes in the complex substances in the leaves into simpler compounds by bacteria *Lactobacillus* sp.

Other changes that occur are increased protein from 13.22% to 19.33%. Increased protein caused by yeast Saccharomyces cerevisiae which is a single cell protein (PST) with a chemical composition consisting of crude protein 50-52%, carbohydrates 30-37%, 45% fat and minerals 7-8% (Reed and Nagodhawithana 1988). In addition, the activity of the Bacillus licheniformis bacteria increases the production of chitinolytic protease enzymes which can break the covalent bonds of protein-mineral chitin which can increase protein content (Sari *et al* 2016).

The fat content in Lemna sp. before and after fermentation showed a slight increase from 2.98% to 2.99%. Increased fat content caused by yeast Saccharomyces cerevisiae which has a fat content of 45% during fermentation (Reed and Nagodhawithana 1988). Fat is needed for growth and energy needs in fish. Fat serves as an energy source and helps to absorb certain minerals (especially calcium) and vitamins that are dissolved in fat (A, D, E, K) (Andriani *et al* 2016).

The content of Material Extraction Without Nitrogen sourced from plant feed material (Andriani et al 2016). The content of Material Extraction Without Nitrogen (BETN) has decreased from 52.30% to 41.34%, due to the activity of the Lactobacillus sp bacteria that can convert complex substances in leaves into simpler compounds. According to Andriani et al (2016) BETN useful to meet energy needs in addition to protein and fat, the carbohydrate feed formulations include both termed BETN.

According to Millamena (2002), carbohydrates and fats are needed to meet energy needs so that proteins can be used optimally for growth.

3.1.2. Daily Growth Rate

Growth is an increase in the size of length and weight at a given time, due to the occurrence of mitotic cell division caused by excess energy inputs and amino acids derived from food (Effendie 2002). Based on the results of research conducted during the 40 days of feeding a mixture of Lemna sp fermented and commercial feed with a different percentage rate differences growth rate shown by the graph increased weight of carp (Figure 1).

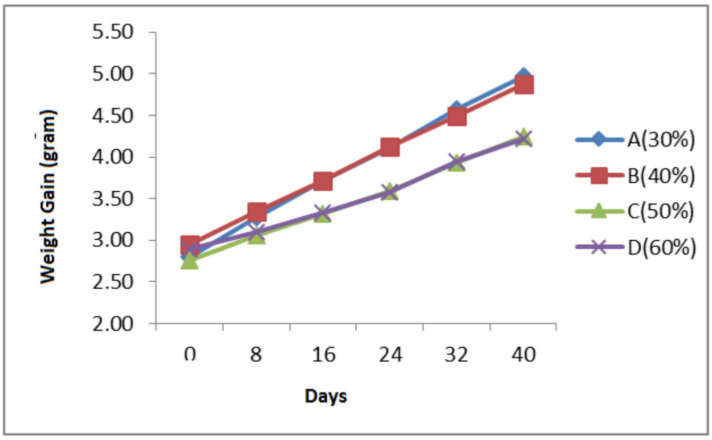

Figure 1. Growth Rate of Giant gourami

Based on Figure 1, the total weight of the highest gourami is treatment A by giving Lemna sp flour fermented as much as 30% resulting in an average final weight of 4.97 grams, followed by treatment B by giving *Lemna* sp. flour fermented as much as 40% resulting in a final weight of 4.88 grams. Treatment C and D with the addition concentration *Lemna* sp. fermented flour as much as 50% and 60% showed a smaller growth rate compared to treatment A and B with an average final weight produced successively 4.25 grams and 4.22 grams.

The effect of treatment on growth rates was analyzed using variance analysis then continued with a Duncan test with a confidence level of 95%. The following is the average value of the daily growth rate of gourami seeds for 40 days of maintenance (Table 2).

Table 1. Value of daily growth rate

Treatment	Description	Average Daily Growth Rate (%)	Notation
A	PK 70% TLF 30%	1.44 ± 0.08	b
B	PK 60% TLF 40%	1.27 ± 0.16	b
C	PK 50% TLF 50%	1.08 ± 0.02	a
D	PK 40% TLF 60%	0.94 ± 0.08	a

Description: Values followed by lowercase letters are not significantly different at the 95% confidence level.

Based on Table 2, the highest daily growth rate is in treatment A with the addition of *Lemna* sp. flour. 30% fermentation yields a growth rate of 1.44%. The smallest value of daily growth rate is at treatment D with a growth rate of 0.94%. Treatment A was not significantly different from treatment B with a daily growth rate of 1.27%, treatment D was not significantly different from treatment C with a daily growth rate of 1.08%. The value of the daily growth rate in treatments A, B and C can be said to be quite good because it is above 1% (SNI 2000). While on treatment D although not significantly different with treatment C has decreased so is not recommended for use.

According to Effendi (1979), growth is influenced by internal factors and external factors. Internal factors that affect fish growth include species, genetic strains, sex, while external factors include feed quality, feed consumption, disease, and the aquatic environment. Based on the results of the research, it is suspected that the value of the growth rate can be caused by the quality of the feed given.

The crude fiber content in *Lemna* sp. flour fermented is 15.38%. The more percentage of addition of Lemna sp flour as a result of fermentation, the greater the content of crude fiber contained in the feed. Meanwhile, the tolerance limit of gourami seeds to crude fiber is 6% because in the larval phase gourami has an imperfect digestive system (Prihartono 2004). According to Guillaume *et al* (1999), crude fiber content causes slow intestinal peristalsis so that the feed given is not absorbed optimally and more quickly removed from the process of digestion.

According to Widyati (2009), the amount of protein in the feed will affect fish growth. According to Prihartono (2004), the minimum protein content needed by gourami seeds is 32%. The protein contained in the Lemna sp flour fermented is 19.33% so that if too many additions will cause the protein value in the feed to decrease, consequently the protein requirements of gourami seeds will not be fulfilled.

The addition of *Lemna* sp flour fermented up to 50% in the test feed produced a good growth rate. This shows that the addition of fermented Lemna sp flour can meet the nutritional needs of gourami seeds. So that it can reduce the cost of feed up to 50%. Meanwhile, the addition of Lemna sp flour. 60% of fermented products have not been able to meet the nutritional needs of gourami optimally. So it is not recommended to be applied in the business of gourami cultivation.

According to Rostika *et al* (2017), the highest daily growth rate is 1.20% with the percentage of addition of fermented *Lemna* sp. meal as much as 40% to feed tilapia. While the daily growth rate of gourami with the percentage of 40% addition of Lemna sp flour. fermentation results are greater, which is equal to 1.27%. These results can be caused by differences in probiotics used for the fermentation process. Based on Rostika et al (2017) using probiotics EM4 while in this study Aquasimba d probiotics were used where the number of microbial colonies in Aquasimbad probiotics was higher. The number of microbial colonies in Aquasimbad probiotics was 10^8-10^9 CFU / ml (Indrianti 2005) while probiotics EM4 had a number of microbial colonies of 107 CFU / ml (Merdana 2016).

Suhendar (2017) study results the best growth rate in Tawes fish is 0.35% with the percentage of addition of Lemna sp flour. fermented as much as 40%. In this study the probiotics used were Aquasimbad. However, the value of the growth rate produced in fish was smaller than that of gourami in the same percentage of addition. This is probably due to differences in fish size and eating habits and the quality of maintenance media. The statement refers to Effendi (1979) that growth is influenced by internal factors and external factors. Internal factors affecting the growth of fish such as species, genetic strains, sexes, while external factors such as feed quality, feed intake, disease, and the environment.

3.1.3. Feed Conversion Ratio

Feed conversion ratio is the amount of weight of feed needed by fish used to grow or increase body weight, the smaller the value of the change in value, the better the quality of the feed given (Mudjiman 1987). Based on the results of research conducted for 40 days the administration of a mixture of Lemna sp. and commercial feed with different percentage percentages by giving as much as 5% of fish body weight (SNI 2000) on each treatment resulted in different FCR values (Figure 2).

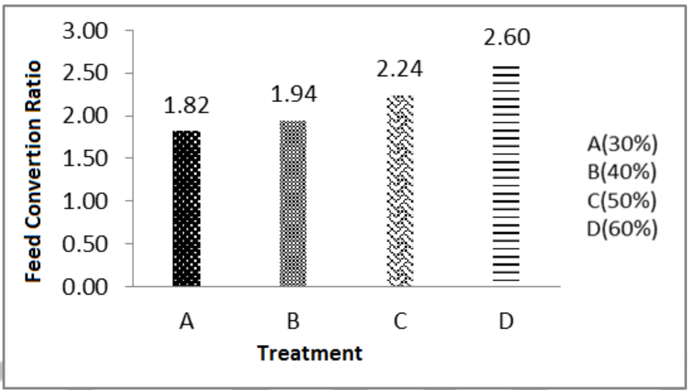

Figure 1. Feed Conversion Ratio

Based on the graph of the average value of the feed conversion ratio in Figure 2, it can be seen that the addition of Lemna sp. fermented products in artificial feed produce RKP values ranging from 1.82-2.60 which means that by feeding as much as 1.82-2.60 kg will produce 1 kg of gourami meat. The smallest RKP value is treatment A with a value of 1.82 followed by treatment B with a value of 1.94 then treatment C with a value of 2.24 and the highest RKP value is treatment D with a value of 2.60.

The feed conversion ratio value obtained is getting smaller, it can be seen that the effectiveness of the feed is getting better where the value indicates that the feed given can be converted into fish body weight. This shows that the best feed conversion value is treatment A with a value of 1.82. The results of the variance analysis were continued by testing the value of feed conversion ratio on gourami seeds shown in the table below (Table 3).

Table 2. Average Feed Conversion Ratio

Perlakuan	Keterangan	Rata-rata RKP	Notasi
A	PK 70% TLF 30%	1,82 ± 0,16	a
B	PK 60% TLF 40%	1,94 ± 0,48	ab
C	PK 50% TLF 50%	2,24 ± 0,09	bc
D	PK 40% TLF 60%	2,60 ± 0,52	c

Description: Values followed by lowercase letters are not significantly different at the 95% confidence level.

Based on the analysis of the fingerprint of the various FCR values of treatment A and B with the addition of Lemna sp flour fermented as much as 30% and 40% did not show any significant difference with the values of 1.82 and 1.94. The treatment of C with the addition of Lemna sp flour. 50% fermentation yield was not significantly different from treatment B and D with an FCR value of 2.24 and the last treatment D with the addition of Lemna sp flour. The fermentation yield of 30% did not show a significant difference with treatment C with an FCR value of 2.60.

According to Retnosari (2007) the size of the Food Conversion Ratio value is about the efficiency of feed obtained, the lower the value of RKP, the more the feed quality. Factors that affect the size of the RKP are the feed source itself, one of which is crude fiber. According to Guillaume et al. (1999), the crude fiber content causes low intestinal peristalsis movement so that the feed given is not absorbed optimally and is released more quickly from the digestive process.

Stephani *et al*. (2014) stated that these were nutrients needed by nutrients needed in various factors such as enzyme synthesis, enzyme production in sufficient quantities, and distribution of enzymes in digestive tissue. Fish size, intestinal length ratio (PU), total body length (PT) and food composition including relevance, gourami contains a small value of small PU / PT, at that size the large value of PU / PT value is large, at this size some the amount of food consists of plants (Affandi 1993).

In the research Rostika *et al* (2017) studied *Lemna* sp. flour. in tilapia fish the best conversion ratio value of 2.97 fermented as much as 40%. The value of the feed conversion ratio is greater than the value of the feed conversion ratio in this study at the same agreement. In other words, add Lemna sp flour. fermentation results using Aquasimba-D in gourami feed is better than using Lemna sp. flour. fermented products using EM4 in tilapia. Because this is gourami which is herbivorous fish (Alamsyah 2008) so that gourami can be more easily digested because it contains Lemna sp. fermented products, according to the statement of Alamsyah *et al* (2009) that gourami can consume food sources derived from plants.

3.1.4. Survival rate

Survival is a comparison of the number of fish that live until the end of maintenance with the number of fish at the beginning of maintenance (Effendi *et al*. 2006). Based on SNI standards, the survival of gourami seeds in IV nursery up to the size of nursery V is as much as 80%. In this study obtained good value for life. The following is a graph of the survival rate for each treatment after 40 days of maintenance (Figure 3).

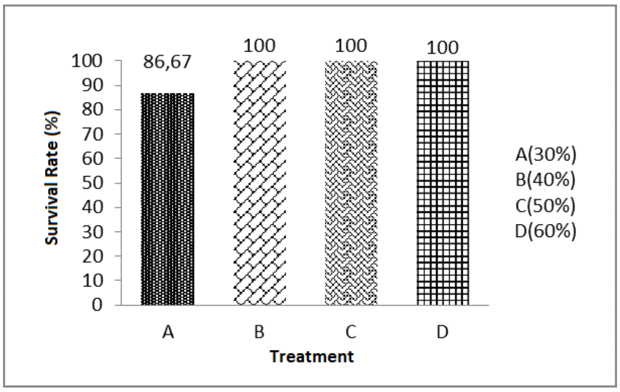

Figure 3. Survival Rate Giant gourami

Based on the graph in figure 6, the survival rate obtained at each treatment averaged more than 90% with the lowest survival rate at treatment A of 86.67%, while other treatments were 100% survival. The value of the survival rate has met the SNI standard where the minimum survival in IV nursery is 80%.

The results of analysis of variance and continued with Duncan test at 95% confidence level showed that Lemna sp flour. fermented results mixed with commercial feed given to gourami with different concentrations did not show a significant effect on the survival rate of gourami (Table 4).

Table 3. Survival Rate Giant gourami

Treatment	Description	Survival Rate (%)	Notation
A	PK 70% TLF 30%	86.67 ± 44.44	a
B	PK 60% TLF 40%	100 ± 0	a
C	PK 50% TLF 50%	100 ± 0	a
D	PK 40% TLF 60%	100 ± 0	a

Description: Values followed by lowercase letters are not significantly different at the 95% confidence level.

In treatment A there is the smallest survival value which is inseparable from the quality of water used as a medium of maintenance and the body's resistance to the fish itself. The size of the fish is greater than that of treatment B, C, and D, which causes a higher density compared to the treatment with the addition of Lemna sp. other fermented products, this causes the movement of fish to become narrow which causes the possibility of friction between individual fishes is greater so that the fish are stressed and more susceptible to disease due to decreased fish endurance. In accordance with the statement of Effendi *et al* (2006) Survival of fish is determined by several factors, including space (density) and water quality. Density is related to fish growth and causes water quality to decline due to a large amount of stool produced. This can lead to stressful fish, the impact of stress results in fish's immune system decreasing causing death.

3.1.5. Water Quality

Water quality greatly affects the growth and reproduction of fish. Water as a medium for the cultivation has several important parameters to be controlled when farming activities take place such as temperature, pH, dissolved oxygen and ammonia content. Water quality is expressed by several parameters, namely physical parameters, chemical parameters, and biological parameters (Effendi 2003).

Table 5. Water Quality Data during the study

Treatment	Average		
	Temperature (ºC)	DO (mg/L)	pH
A (30%)	30	5.9	7.6
B (40%)	29.4	6	7.6
C (50%)	30.2	5.8	7.7
D (60%)	30.1	5.6	7.6
SNI (2000)	25-30	5.1-6.5	6.5-8.5

Water quality during the study in each treatment obtained temperature values ranging from 29.4-30.2^oC. According to Irianto (2005), the water temperature can affect the metabolic process in fish, generally, high temperatures will accelerate the metabolic process in fish. While low temperatures can reduce the health of fish, because low temperatures will cause stress levels in fish to increase, making it more susceptible to disease. According to SNI (2000), Gouramy can grow well at a temperature range of 25-30^oC. Thus the temperature range in the fish maintenance media in the study still supports the growth and survival rate of gourami.

Dissolved oxygen is a chemical parameter of water which is an important factor that determines the life of an aquatic organism, in waters with low oxygen content the fish will be easily stressed and die (Nisa, *et al*. 2013). Based on observations, the oxygen content in maintenance media ranged from 5.6 to 6.0 mg / L while according to SNI (2000) optimal dissolved oxygen ranged from 5.1 to 6.5 mg / L. The dissolved oxygen content in maintenance media during the study supported the survival of gourami. Adequacy of oxygen content in maintenance media is supported by the presence of aeration installations as oxygen supply to maintenance media.

pH is a chemical parameter of water, changes in pH of water media have a very significant effect on the survival of fish seeds. So that pH needs to be considered for fish maintenance. The ideal pH for gourami maintenance is 6.5-7.0 (Nisa, et al. 2013). Based on the measurement results of pH values on maintenance media, it ranged from 7.6-7.7, indicating that the pH in maintenance media was quite high, but still within the tolerance limits of carp.

4. CONCLUSION

1. The results of changes in the nutritional value of feed showed an increase in crude protein from 13.22% to 19.33% and a decrease in crude fiber from 20.08% to 15.38%.
2. 30% balance of *Lemna* sp flour. fermented products and 70% commercial feed on gourami feed produced the best daily growth rate with a value of 1.44%, feed conversion ratio 1.82 and survival rate of 86.67%.

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