Sintechcom: Science, Technology, and Communication Journal
Vol. 2, No. 1, October 2021, pp. 26-31

Observation of Growth Rate of Catfish (Pangasius sp.) Against Mixed Feed Fermentation of Mustard and Cabbage Waste Flour

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ABSTRACT

A study was conducted to measure the growth rate of catfish (Pangasius sp.) due to feeding on a mixture of fermented mustard and cabbage waste flour (FMCWF). Catfish are distributed in each container per box, consisting of five fish with an initial weight of 3-5 grams. During 56 days of cultivation, three times a day were fed with a feeding rate of 5%. The randomized block design method was used as the concept of this research. There were five treatments and each treatment was repeated three times. The type of catfish feed provided consisted of factory feed and its mixture with different percentages of FMCWF: P0 (Manager Feed brand Matahari Sakti); P1 (FMCWF 15%); P2 (FMCWF 30%); P3 (FMCWF 45%); and P4 (FMCWF 60%). Observations were made on several parameters such as absolute weight growth, feed conversion ratio, and water quality. Based on the ANOVA test (analysis of variance), the results showed that the growth rate of catfish was influenced by FMCWF with a significant effect ($p<0.05$). The best growth rate was given to P2 treatment (FMCWF 30%) with an absolute weight growth of 8.11 g and a feed conversion ratio of 1.5.

ARTICLE INFO

Article history:

Received Jun 6, 2021
Revised Oct 22, 2021
Accepted Oct 29, 2021

Keywords:

Catfish (Pangasius sp.)
Growth Rate
Fermentation
Mustard Waste
Cabbage Waste

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1. INTRODUCTION

Cultivation of catfish (Pangasius sp.) is a freshwater fish business that has great potential and is quite dominantly carried out by some people. There are various benefits from such cultivation, including high economic and nutritional value. One of the important factors that must be considered in supporting the success of fish farming is the provision of feed which depends on the type and quality. In addition, the cost of feed production is generally estimated to reach 60-70% of the total expenditure for the development of fish farming [1] Therefore, with the high cost of feed production, the use of certain raw material sources can be used as a solution to procure cheaper and quality feed.

Vegetable waste is an organic raw material that has the potential to be used as a fish feed mixture. Some vegetable waste, especially mustard and cabbage, can be found in the market from the remnants of sorting the damaged vegetable parts during harvest and distribution from farmers to sellers [2]. There is potential for the use of vegetable waste as an alternative feed raw material that can be used as a solution to overcome the problem of high feed production costs. In addition, the use of vegetable waste can reduce piles of organic waste and pollution of the surrounding environment.

Based on the structure and content of vegetables, mustard greens and cabbage have high fiber content and low protein content, so the utilization of this waste is problematic as raw material for fish feed. However, these obstacles can be overcome by the fermentation process using Rhizopus sp. to improve the nutritional quality of mustard and cabbage waste [3]. There are various enzymes in Rhizopus sp. such as proteases, pectinases, amylase, and lipases which are all mold producers. The protease enzyme in Rhizopus sp. has an important role during the fermentation process, where complex protein molecules are broken down by high proteolytic activity [4, 5]. Based on research by

Sitorus (2019), the use of Rhizopus sp. in the fermentation of mustard and cabbage waste flour (FMCWF) there was an increase in crude protein from 9.64% to 19.91% and crude fiber from 21.50% to 12.30% [6].

Identified vegetable waste such as mustard greens and cabbage has the potential to be used as an alternative raw material for fish feed with quality improvement through fermentation using the enzyme Rhizopus sp. However, the effect of fish feed from vegetable waste on the development of fish farming needs to be studied. Therefore, this study aimed to determine the growth rate of catfish due to feeding mixed with FMCWF. In addition, several parameters of aquaculture success indicators such as absolute weight growth, feed conversion ratio, and water quality also need to be investigated.

2. PREPARATION OF TEST AND MEASUREMENT

The review of the growth rate of catfish was carried out for 56 days. There are 15 units of containers, each measuring 35 x 24 x 24 cm, where each container contains five fish weighing about 3-5 grams and 3-5 cm long. All available containers are filled with water, then allowed to stand for a day and a night to adjust to the conditions in the surrounding environment [7]. Furthermore, the test fish were put into each container with a predetermined amount and acclimatized for a week using control feed. After a week, the fish were not fed for a day and then weighed to equalize the total weight of the fish to 18 grams for each container. In a day the fish are fed 5% of their weight three times [8]. Every day the rest of the feed was taken to calculate the net weight of the remaining feed. Water quality measurements are carried out once a week which includes dissolved oxygen (DO), temperature, and pH. After that, the container is cleaned and the water is replaced [9].

The collection of mustard and cabbage waste is obtained from vegetable sellers in the market. The vegetable dregs are washed and thinly sliced then dried in the sun, after drying the dregs are ground into flour. The ground mustard and cabbage waste flour are then mixed 1:1, after that, it is fermented using Rhizopussp at a dose of 3 grams from each kilogram of mixed material [10] and stirred until evenly distributed. The mixture is then steamed for 10 minutes, then put in a perforated plastic bag. After fermentation for ± 36 hours [6], the waste material is mashed and ready to be mixed into the feed with a certain percentage level.

The mixture of feed ingredients must be formulated according to the fish protein requirements of at least 25%, maximum crude fiber 8%, and crude fat at least 5% [11]. Calculation of the nutritional content of mixed feed ingredients using the worksheet method [12, 13]. The mixed feed ingredients consisted of FMCWF, soy flour, fish flour, wheat flour, vitamin-mineral mixture, and fish oil. Making the test feed begins by mixing all the ingredients of the formulation until evenly distributed. Warm water is added during the mixing process to make the dough easy to clump [14]. The test feed dough that has clotted is then printed and dried directly in the sun. The composition and nutritional content of the test feed ingredients can be seen in Table 1.

Table 1. The composition and nutritional content of test feed

Ingredients	Treatment (%SF: FMCWF)				
	P0	P1	P2	P3	P4
	%B	%B	%B	%B	%B
FMCWF	Manufactrured	15	30	45	60
Soy Flour	Feed	45	30	15	0
Wheat Flour	PF- 1000	5	5	5	5
Fish Flour		32	32	32	32
Fish Oil		2	2	2	2
Vitamin dan Mineral Mix		1	1	1	1
Total	100	100	100	100	100
Crude Protein (%)	33 [1]	38.38	35.69	32	30.29
Crude Fiber (%)	5 [1]	4.72	5.81	6.91	8
Crude Fat (%)	6 [1]	11.53	8.99	8	3.93

Information: SF is soy flour; %Bis Percentage of used ingredients (%)

This study used an experimental method with a randomized block design. There were five treatments, each of which was repeated three times. The treatment given was a modification of

Sitorus's research (2019) [6]. The treatments given wereP0 (MatahariSakti manufactured feed),P1 (15% of FMCWF),P2 (30% of FMCWF),P3 (45% of FMCWF), and P4 (60% of FMCWF).

The data collected was under the observation parameters: absolute weight growth, feed conversion ratio, and water quality. The weight of the test fish was weighed every seven days using an analytical balance. According to Septimesy et al. (2016) [15], the formula for calculating absolute weight growth is as follows:

$$\Delta W = W_t - W_0 \quad (1)$$

whereΔW is absolute weight growth(g), $W_0$is fish average weight at the start of cultivation (g), and W_t is fish average weight on the time of t of the cultivation (g).

According to Tahapari and Darmawan (2018) [16],formula for calculating fish feed conversion:

$$FCR = \frac{F}{(W_t + D) - W_0} \quad (2)$$

where FCR is feed conversion ratio, F is total of given feed (g), W_t isfish biomass at the end of the study (g), D is dead fish biomass (g), W_0 isfish biomass at the start of the study (g).

Measurements were made every seven days before water change within 56 days of cultivation. A thermometer was used to measure temperature, a pH meter to measure the degree of acidity (pH), and a DO meter to measure DO [17, 18].

Data from the research results of absolute weight growth and feed conversion ratio were analyzed using the SPSS version 25 application program. Collected quantitative data were tested for normality and homogeneity first, then analyzed using analysis of variances (ANOVA). If the test results between treatments are significantly different, where F count is greater than F table, then the duncan multiple range test (DMRT) will be carried out at a significance level of 5%. Water quality data were analyzed descriptively using SNI 7471.2: 2009 [11].

3. ANALYSIS OF GROWTH RATE OF CATFISH

Absolute weight growth is the difference between the fish's average weight at the end and the beginning of the study. The weight gain of catfish increases with increasing cultivation time. Following is the weight gain of catfish for 56 days of cultivation (Figure 1).

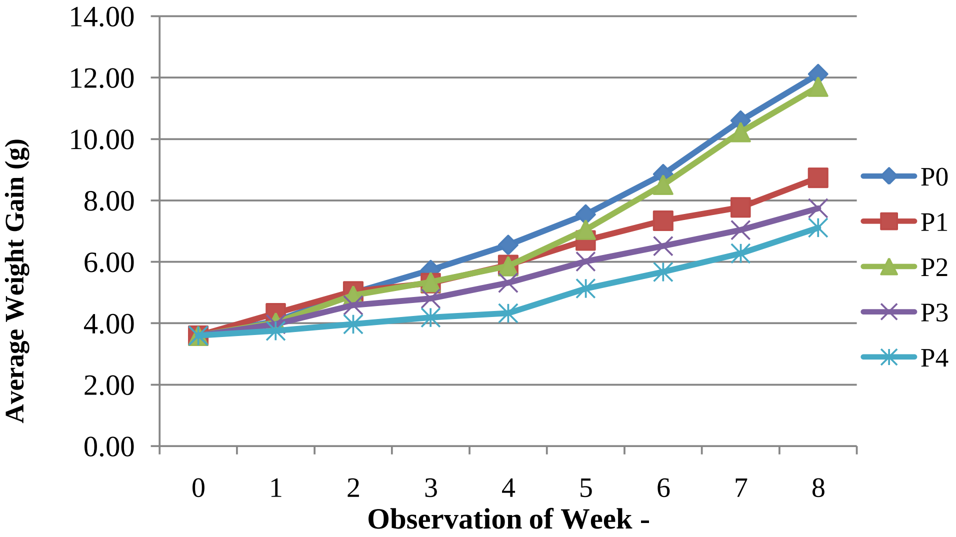

Figure 1. Average weight gain of catfish

In Figure 1, it can be seen that the first week to the third week of the average weight gain is slow, ranging from 0-2 g. The weight gain of catfish tended to be faster at week 4 to week 8, but the results differed in each treatment except P0 and P2 treatments. The absolute weight growth of catfish is presented in Table 2.

Table 2. Catfish absolute weight growth

FMCWF	Parameter
	Absolute Weight Grow (g)
P0 (Manufactured Feed)	8,52±0,99
P1 (15% FMCWF)	5,14±0,48
P2 (30% FMCWF)	8,11±0,42
P3 (45% FMCWF)	4,14±0,25
P4 (60% FMCWF)	3,51±0,38

ANOVA test results on the growth of catfish's absolute weight found that the treatment of FMCWF with different percentages significantly affected the absolute weight growth of catfish. The treatment that produced the ighest absolute weight growth was control treatment 8.52 ± 0.99 g. Based on the DMRT test, the control treatment was not significantly different from the P2 treatment (30% FMCWF) 8.11 ± 0.42 g. During cultivation, catfish used different amounts of feed. The feed conversion ratio shows the ratio between the biomass of fish produced and the total fish feed. Data regarding the catfish feed conversion ratio during the study is presented in Table 3.

Table 3. Catfish feed conversion ratio

FMCWF	Parameter
	Feed Conversion Ratio
P0 (Manufactured Feed)	1,84±0,03
P1 (15% FMCWF)	2,11±0,03
P2 (30% FMCWF)	1,58± 0,04
P3 (45% FMCWF)	2,57± 0,14
P4 (60% FMCWF)	2,64± 0,18

Based on the ANOVA, the conversion ratio of catfish feed, it was found that the treatment of FMCWF with different percentages had a significant effect on the conversion ratio of catfish feed. Treatment with 30% FMCWF resulted in the best feed conversion ratio of 1.58 ± 0.04. An important factor affecting environmental conditions during fish rearing is water quality to affect the fish metabolic process. The data from the measurement of water quality are presented in Table 4.

Table 4. Water quality

FMCWF	Parameter		
	Temperature (℃)	pH	DO (mg/l)
P0 (Manufactured Feed)	27-31	5,93-6,91	4,3-5
P1 (15%)	27-30	5,56-6,60	4,1-4,9
P2 (30%)	27-31	5,92-6,94	4,3-5
P3 (45%)	27-31	5,18-6,12	4,2-4,7
P4 (60%)	27-31	5,13-5,98	4,1-4,6

The temperature obtained during the study ranged from 27-310C. This temperature is in the optimal range to support growth according to Diana and Ernawati (2014) [19], Oktavianto (2014)[20] and is under SNI 7471.2: 2009 [11]. In pH parameters, the pH range obtained during the study was 5.13-6.94. The pH range obtained is quite good, still acceptable for catfish, is at the limit value according to Diana and Ernawati (2014) [19], Oktavianto (2014) [20], and is under SNI 7471.2: 2009 [11]. In the DO parameter, the DO obtained ranged from 4.1 to 5 mg / l. Overall, the DO value during the study was classified as an optimal condition to support growth according to Diana and Ernawati (2014) [19], Oktavianto (2014) [20] and is under SNI 7471.2: 2009 [11].

4. CONCLUSIONS

This study shows that the provision of fermented mustard greens and cabbage waste flour as a mixture of feed ingredients to replace soybean flour has a very significant effect ($p < 0.05$) based on the Analysis of Variance (ANOVA) test on the growth of catfish on parameters of absolute weight growth and feed conversion ratio. Treatment P2 (30% FMCWF) produced catfish's best growth based on the parameters of absolute weight growth of 8.11 g, absolute length growth of 1.41 cm, relative growth of 225.2%, and feed conversion ratio of 1.58. The treatment in this study can be used as a solution for catfish cultivators in overcoming the problem of high feed procurement costs by making alternative feeds to produce maximum catfish growth and almost the same as manufactured feed.

ACKNOWLEDGMENT

Thank you to the Ministry of Education and Culture DRPM TA 2021, PDUPT Scheme. The researcher would like to thank the Minister of Education and Culture of the Republic of Indonesia, Mr.Nadiem Anwar Makarim, BA. MBA, and the Riau University Research and Community Service Institute (LPPM) and all those who have participated.

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