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Growth Performance of *Pangasius sp* Fed Different Types of Diets Formulated from Varieties Fish Meal Sources

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ABSTRACT

Pangasius sp is an introductory species that is widely distributed in freshwater regions in Indonesia since the 1990s and it was initiatively reared at the beginning of 2011 using a floating net cage in Lake Ngade, Ternate. Even though it has benefited economically, there is still a lack of information on its biological and ecological aspects. Growth and survival rate are two main factors that should be known to develop Pangasius aquaculture. The study aims to understand the growth and survival rate of Pangasius by mixing different fish meals into dietary. 120 Pangasius fingerlings were placed into 12 tanks. Diet was formulated using Pearson's square method. Three different protein fish meal sources were mixed into feed formulation namely flying fish meal, Nile meal, and eel meal. Commercial feed was used as control. Filling Randomized Design (FRD) was applied with the experimental set-up of the treatments. The results show that feed stability in water ranges from 2'23" to 3'47" while feed durability ranges from 2'09" to 2'35". The survival rate of Pangasius is almost 100% except for treatment C. Growth rates vary among treatments which is the highest found in treatment A (16.42%) followed by treatment B (15.85%), D (15.57%), and C (7.00%) respectively. Nile fish meal is also significantly affected ($P<0.05$) by the Specific Growth Rate (SGR) of fish. Nutrition ingredients and water quality parameters are conducive to maintaining the fish's life. All in all, different fish meal sources in the formulated diet are significantly supporting Pangasius growth.

Keywords: Diet formulation, Fish meal, Growth, Pangasiid fingerlings

ABSTRAK

Ikan Patin (*Pangasius sp*) merupakan spesies introduksi yang tersebar di perairan tawar Indonesia sejak tahun 1990an, dan awal mula dibudidayakan di Ternate adalah di keramba jaring apung Danau Ngade pada tahun 2011. Walaupun menguntungkan secara ekonomi, namun informasi tentang biologi dan ekologi masih sangat kurang. Pertumbuhan dan sintasan merupakan dua faktor utama yang harus diketahui dalam pengembangan budidaya ikan patin. Penelitian ini bertujuan untuk mengetahui pertumbuhan dan sintasan ikan patin yang diberi jenis tepung ikan berbeda dalam campuran formulasi pakan buatan. 120 ekor ukuran fingerling ditempatkan pada 12 akuarium. Pakan buatan diformulasi menggunakan metode bujursangkar Pearson. Tiga penyumbang protein tepung ikan yang berbeda yaitu tepung ikan layang, tepung ikan nila, dan tepung ikan sidat dicampurkan pada formulasi pakan. Pakan komersial digunakan sebagai kontrol. Penelitian dilakukan secara eksperimen menggunakan RAL (Rancangan Acak Lengkap). Hasil penelitian menunjukkan uji daya apung berkisar 2 menit dan 23 detik hingga 3 menit 47 detik, dan daya tahan pakan di dalam air adalah 2 menit 09 detik hingga 2 menit 35 detik. Sintasan sebesar 100% kecuali pada perlakuan C. Laju pertumbuhan tertinggi berturut-turut pada perlakuan A (16,47%), B (15,85%), D (15,57%), dan C (7,00%). Penggunaan tepung ikan nila berpengaruh signifikan (P<0,05) pada SGR ikan. Kandungan nutrisi pakan dan kualitas air sangat baik. Secara keseluruhan, penggunaan tepung ikan yang berbeda pada pakan formulasi secara signifikan menunjang pertumbuhan ikan patin.

Kata kunci: Formulasi pakan, Tepung ikan, Pertumbuhan, Fingerling ikan patin

INTRODUCTION

Pangasius sp has been known as a freshwater commodity broadly in Indonesia since the 1990s. This species was initially introduced to Indonesia from Vietnam, Thailand, and mostly from larger rivers in Sumatra, Borneo, and Java (Gustiano et al., 2018). The distribution of habitat includes rivers, swamps, reservoirs, and lakes (Gupta, 2016).

The phenotypic characteristics are streamlined body, scissors-shape of the caudal fin, silver belly, wide and sub-terminal mouth, long twin beard, soft meat texture, and delicious taste (Slembrouck et al., 2003). These last two features make Pangasius more preferred by the public, and then it is reared as an aquaculture commodity economically (Sadi & Yoga, 2021). Besides that, it grows fast when culture it and it has higher market demand (Hoque et al., 2021). In Ternate, the information on Pangasiid is still lacking. Initially, the culture was conducted in 2011 at the floating net cage of Lake Ngade which becomes one of the local culinary destinations. However, the reared activities are still seasonal which depends on larval supply and production cost in one maintenance cycle.

In the production cycle of Pangasiid aquaculture, the most important problems are the reduction in feed costs and the production of high-quality feed. Generally, 60-70% of operational expenditure in aquaculture is feed availability due to the high price of meal sources and usually, it is imported from other countries (FAO, 2022). Even though the market demand has improved significantly, the fish farmer still has a low income. Providing self-formulated artificial feed is an alternative solution that can be done (Tugiyono et al., 2020). The availability of local raw materials is the key in the preparation of diet formulations. Therefore, efforts to prepare raw materials that have high nutrition, easy to obtain, and do not compete with human needs are crucial (Workagegn et al., 2014). The selection of material sources mainly to protein ingredient contribution is needed to be considered (Iskandar & Fitriadi, 2017).

The protein content is used as the energy source for standard metabolism and fish growth. The role of an essential amino acid in the diet participates in various functions of the body such as muscle tissue construction, enzyme production, and many others (Zeng et al., 2021). The higher the amino acid content in the diet, the better protein quality, and vice versa (Yuangsoi et al., 2016). Feed that has high biological value can stimulate greater body protein accumulation compared to protein feed with low biological value. Hence, a diet formulation that has different protein contents will give a better result for fish growth (Korkut et al., 2017).

The primary source of protein diet can find in fish meal. However, fish meals that are using protein content sources are facing problems in related to a proper protein raw materials. According to (Park et al., 2021), different raw protein contents particularly from fish meal will gain better the growth performance and sex maturation. This study objective is to know the growth and survival rate of Pangasius given different fish meal sources on diet formulation.

METHODOLOGY

120 fingerlings Pangasius size 10 cm was used as an object of treatment (Effendi, 1979). Each aquarium was filled with 10 individuals, then there were 12 aquaria for an experimental setup.

A 3x4 randomized completely design was used to evaluate the effect of diet on four different sources of fish meal as below:
Treatment A: Nile fish meal (30% of protein)
Treatment B: Eel fish meal (30% of protein)
Treatment C: Flying fish meal (30% of protein)
Treatment D: Control/commercial feed (31% of protein)

Formulated fish composition for each treatment can be seen in Tables 1, 2, and 3.

Table 1. Diet composition on treatment A (30% of protein content in 100 g of diet).

Feed source	Protein content (%)	Feed source usage (g)	Protein content usage (%)
1	2	3	4=(2x3)
Nile fish meal	17,80	28,00	4,98
Ketapang leave meal	20.99	10,00	2,09
Coconut cake	20,50	5,00	1,02
Corn meal	9,00	4,00	0,36
Anchovy head meal	68,07	20,89	14,21
Tofu dregs	23,55	31,10	7,32
Vitamin premix	-	1,00	-
Total amount		**100,00**	**30,00**

Table 2. Diet composition on treatment B (30% protein content in 100 g of diet).

Feed source	Protein content (%)	Feed source usage (g)	Protein content usage (%)
1	2	3	4= (2x3)
Eel fish meal	18,40	28,00	5,15
Ketapang leave meal	20,99	10,00	2,09
Coconut cake	20,50	5,00	1,02
Corn meal	9,00	4,00	0,36
Anchovy head meal	8,07	20,48	13,94
Tofu dregs	23,55	31,31	7,37
Vitamin premix	-	1,00	-
Total amount		**100,00**	**30,00**

Table 3. Diet composition of treatment C (30% protein content in 100 g of diet).

Feed source	Protein content (%)	Feed source usage (g)	Protein content usage (%)
1	2	3	4= (2x3)
Flying fish meal	18,13	28,00	5,07
Ketapang leave meal	20,99	10,00	2,09
Coconut cake	20,50	5,00	1,02
Corn meal	9,00	4,00	0,36
Anchovy head meal	68,07	20,48	13,94
Tofu dregs	23,55	31,31	7,37
Vitamin premix	-	1,00	-
Total amount		**100,00**	**30,00**

Parameter of measurement includes:

1. Physical measurement of feed (buoyancy and stability in the water column) is the time of feed that floats on the water surface until go down, and the time of feed can disperse into the water column.

2. The survival rate is measured as followed (Djajasewaka, 1985):

$$SR = \frac{Nt}{No}\ x\ 100\ \% \quad (1)$$

where, SR: survival rate (%)
Nt: number of fish alive at the end of study (individual)
No: number of fish at the beginning of the study (individual)

3. Growth (Zonneveld et al., 1991):

$$W = Wt - Wo \quad (2)$$

where, W : Growth (g)
Wt : final body weight (g)
Wo : initial body weight (g)

4. Specific Growth Rate (Zonneveld, N., E.A.Huisman., 1991):

$$SGR = \frac{(In\ Wt - In\ Wo}{t}\ X\ 100\ \% \quad (3)$$

where, SGR : Specific growth rate (%BW/day)
Wt : final body weight (g)
Wo : initial body weight (g)
t : rearing time (day)

Pangasius was reared for 42 days and was given 5% feed from its biomass. The frequency of feeding fish was 4 times a day. Diet nutrition ingredients were obtained using proximate analysis in the Veterinary laboratory at one of the universities in the city of Makassar, whereas the water quality parameter was measured in situ. Data obtained was calculated using the statistical tools of ANOVA.

RESULTS AND DISCUSSION

Physical measurement of diet can be done by observing the softness and hardness of formulated feed which affects feed stability in the water column. The purpose of this activity is to know the buoyancy of the diet in water. The study result is shown in Table 4.

Table 4. Physical measurement of formulated diet

Treatment	Feed buoyancy	Feed stability
A	2 min 23 sec	2 min 10 sec
B	2 min 13 sec	2 min 09 sec
C	3 min 47 sec	2 min 35 sec

Based on the floating time of feed on surface water, treatment A has the fastest time before sinking to the bottom i.e. 2 minutes and 23 seconds which means it needs 30 seconds to drown. On the other hand, treatment B only has 2 minutes and 13 seconds to sink or 25 seconds. Treatment C has the longest time to float which is 3 minutes and 47 seconds, and it needs 30 minutes to go down. The usage of the same binder on diet formulation gives the same texture but different floating times. This can be assumed that the water content of the diet is different so which will affect the strength and buoyancy of the diet. It revealed by (Orire & Sadiku, 2014) that the usage of floating catalysts on feed formulation supported the buoyancy positively in the water column.

Feed endurance measurement is also conducted to observe whether the feed has a longer time to disperse in the water column or not. Treatment C has the longest time to disperse in water (2’35”). (Yulianto, 2018) classified that diet which has 2-3 hours solubility in water as a good diet physically. If the feed was deployed before 2-3 hours, it is categorized as the bad one as well as more than that hours. Fish has not enough time to consume properly. On the other hand, the longer time the diet is in the water column, the more difficult of fish to crush it.

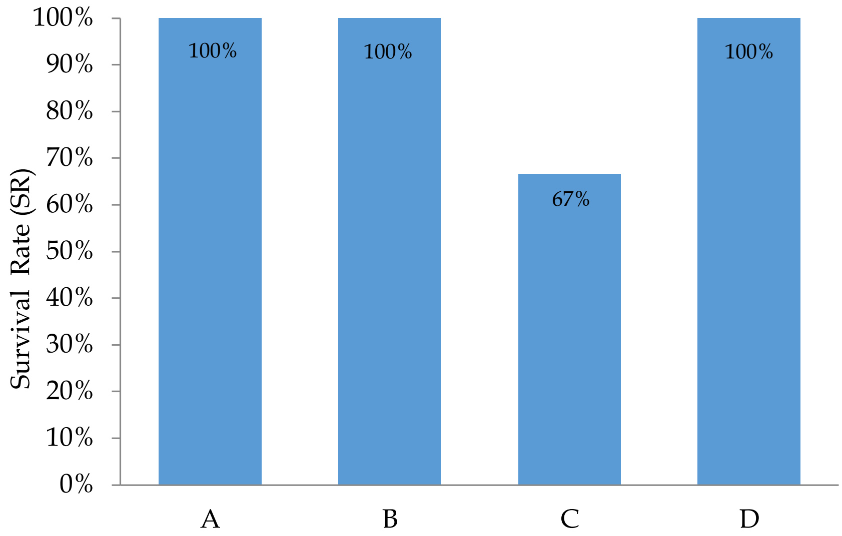

Figure 1. The survival rate of Pangasius in different treatments

The highest survival rate is given by treatments A, B, and D. It is likely caused by the ability of Pangasiid in digesting diet appropriately in their stomach which is shown by fine feces. The given diet is suitable for the larva's mouth opening and easy to respond to. On the increasing total biomass graph of fish, treatment A has the highest number which is 1.15 g. It is followed by treatments B (1.11 g), D (1.09 g), and C (0.49 g), respectively.

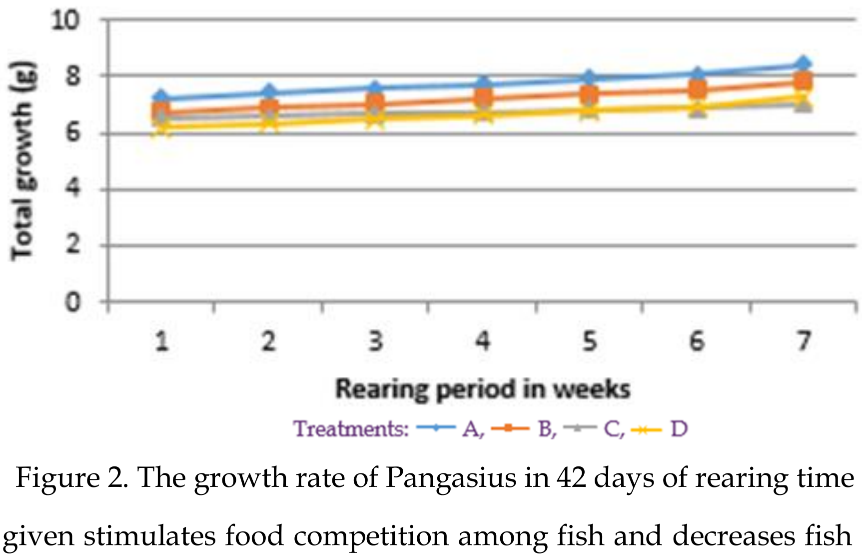

Figure 2. The growth rate of Pangasius in 42 days of rearing time

The low feed given stimulates food competition among fish and decreases fish growth. In the end, the number of fish harvested will decline and will give different variations in size. Otherwise, the larger number of given feed may pollute water due to the accumulation at the bottom. It escalates ammonia and envenoms fish slowly. Besides, it spends costs on the rearing cycle. This is in agreement with the statement of (Craig & Helfrich, 2017) who stated that overfeeding results in water pollution, low dissolved oxygen levels, increased biological oxygen demand, and increased bacterial loads which lead to fish mortality.

Based on Figure 3, reveals that SGR results are similar to the growth rate. Treatment A (16.42%) has a higher number than B (15.85%), D (15.57%), and C (7.00%), serially. According to (Halver & Hardy, 2002), the excess energy input and amino acids from proper food will support fish growth. Eaten feed is firstly used for metabolism process and swimming activity. Next, the energy is absorbed and restored for reproduction purposes, and the rest is earmarked for growth.

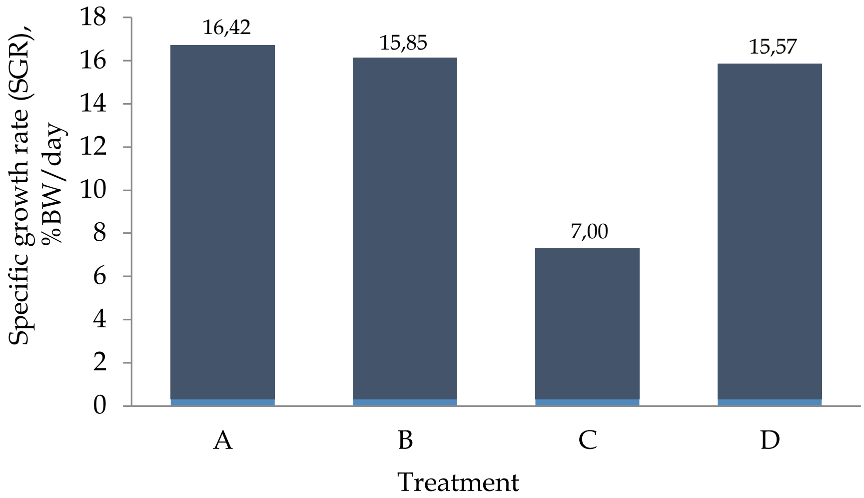

Figure 3. Specific growth rate of Pangasius in different treatments

The results of the present study also revealed that all the experimental diets were accepted by fingerlings Pangasius. This implies that the different experimental feed ingredients did not affect the palatability of the diets. The lower SGR of the fish fed on diet C could be due to the higher fiber level in this diet as shown in Table 5. This result is in line with the previous work of (Kamarudin et al., 2018) who reported that feeding with a higher concentration of fiber in fish diets reduces the digestibility of protein as well as the bioavailability of nutrients which intern reduces the growth performance of the fish.

Table 5. Nutritional contents of each experimental feed

Proximate Analysis (%)	**Diet**		
	A	**B**	**C**
Crude protein	73.20	74.62	67.66
Crude lipid	14.27	4.00	15.32
Crude fiber	0.26	0.38	0.55
Nitrogen-free extract material	4.24	4.51	4.40
Ash	8.03	16.50	12.07
Moisture	7.24	13.03	8.48
Calcium	1.14	3.40	1.68
Phosphate	0.89	1.60	1.02

Proximate analysis was performed to understand the ingredients of the supplemental diet. Balance nutrients have resulted from a balanced mixture of diet ingredients than only uses inadequate feed components to formulate dietary fish (Bhuiyan et al., 2016). The percentage of crude protein from different fish meal sources ranged from 67.66% - 74.62%. This high percentage indicates that entire diets are sufficient for the protein needs of fish's growth. (Pratiwi et al., 2020) stated that 30-60% of protein content is importantly needed to reach maximum performance of catfish production. Interestingly, the percentage of crude lipid varies among experimental diets in which eel fish meal has the lowest number (4.00%) compared to others that much higher (14.27%-15.32%). It is probably related to the life cycle of eels which migrated species so that low restored fat levels in their body. Lipids and their constituent fatty acids (FA) play significant roles in various functions of organisms such as growth, reproduction, health, etc. (Dawodu et al., 2012). The fiber content for all diets is very low number whereas ash content is similar with the research that has been done by (Herdiyanti et al., 2018). It is reported that ash can be represented the mineral content of diet which allowable rates of 3-7% and cannot be applied to the main fish feed constituent.

The growth performance and survival rate of Pangasiid fingerlings were affected by different environmental factors such as water quality parameters including water temperature, pH, nitrogen waste, dissolved oxygen concentration, food quantity and quality, genetic factor, sex of the fish, and their interaction (Boyd & Pillai, 1985). However, the average values of all water quality parameters recorded during the experiment were not significantly different ($P > 0.05$) and were within a suitable range for the normal growth performance of Pangasius as shown in Table 6.

Table 6. Water quality for each treatment during the study

Treatment/repetition	**Parameter**			
	Temperature (^{0}C)	**DO (ppm)**	**Salinity (ppt)**	**pH**
A1	25-27.0	5	31-34	7.8-7.92
A2	25-26.7	5	31-34	7.8-7.92
A3	25-26.7	5	31-34	7.8-7.92
B1	25-26.7	5	32-35	7.0-7.92
B2	25-26.7	5	32-35	7.0-7.92
B3	25-26.7	5	32-35	7.0-7.92
C1	25-26.7	5	32-35	7.0-7.95
C2	25-26.7	5	32-35	7.0-7.95
C3	25-26.7	5	32-35	7.0-7.95
D1	25-26.7	5	31-34	7.8-7.95
D2	25-26.7	5	31-34	7.8-7.95
D3	25-26.7	5	31-34	7.8-7.95

CONCLUSION

This present study tends to estimate the feed composition of some fish meal sources fed to Pangasius fingerlings. During the rearing time, it is obvious to concentrate on formulated diet given to growth performance, in terms of increasing body weight of culture species. The type of feed which use local raw materials has a good nutritional level for the bodybuilding and survival rate of fish. It is important to notice that a supplemental self-formulated diet can be applied to local fish farmers and in developing aquaculture industries nowadays.

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