Effect of Carbohydrate Level and Frequency of Feeding on Total Digestibility and Survival of White Snapper (Lates calcarifer, Bloch)

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Abstract

This study aims to determine the level of carbohydrates and the frequency of feeding on the total digestibility and survival of barramundi fry (Lates calcarifer, Bloch). This study used a completely randomized design with a factorial pattern with two factors and three replications each. The treatments tested were factor A (carbohydrate content, namely 30, 35 and 40%) and factor B (frequency of feeding 2, 4 and 6 times per day). The white snapper used had an average weight of 0.39 g per individual. The feed dose is set at 20-10% of the body weight of the white snapper fry with the frequency of feeding adjusted to the treatment. The results showed that the carbohydrate level of the feed, the frequency of feeding and the combination of the two had a significant effect on the total digestibility of the white snapper seed feed with the best combination at the carbohydrate level of 40% and the frequency of feeding 6 times per day. Treatment of carbohydrate level, frequency of feeding and the combination of the two did not significantly affect the survival of white snapper fry.

Key Words: Carbohydrate Level, Feeding Frequency, Total Feed Digestibility, Survival

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Introduction

White snapper (Lates calcarifer, Bloch) is one of the commercial aquaculture commodities to be developed. Currently, the demand for white snapper for both domestic consumption and export needs is increasing, so it must be immediately balanced with aquaculture (WWF Indonesia, 2015). White snapper is a flesh-eating organism (carnivore) that requires 43% of feed protein (Feed Development Section, 1994). However, the use of protein that is too high will actually lead to high feed costs in a cultivation business. Almost 60-70% of the total production cost is used to purchase feed (Haryati et al., 2010).

The use of protein that is too high will also cause the waste generated in the form of ammonia-N to reduce the water quality of the cultivation media. The research results of Usman et al. (2010) stated that the total N waste per 100 g of feed that enters the waters increases with the increase in the protein content of the feed. The protein content in feed must be limited in number, protein is optimized only for growth, while energy needs are met from other sources, namely carbohydrates (protein-sparring effect by carbohydrates) at lower prices (Zainuddin et al., 2014). Hari et al. (2004) stated that the addition of carbohydrates in the feed will actually reduce the Total Ammonia Nitrogen (TAN).

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One way that can be developed to overcome the above problems is to reduce feed protein and increase feed carbohydrates and then combine it with the frequency of feeding. The frequency of feeding affects the digestive process, so that the frequency of feeding is more frequent (there is an optimal limit) then the carbohydrates that enter are also little by little so that snapper which is a carnivorous fish with a low amylase enzyme is able to digest its food because the enzyme concentration is in accordance with the substrate concentration (Shiau, 1997). So in this study, researchers wanted to determine the effect of carbohydrate levels in the feed combined with the frequency of feeding and the combination of both which can provide the best response to increase total digestibility and survival of white snapper fry. (Lates calcarifer, Bloch).

Methods

The test animals used in this study were white snapper with a weight of ±0.39 g per head and a length of ±3 cm. Fish maintenance is carried out for 60 days in August-October 2020 at the Takalar Brackish Water Aquaculture Fisheries Center, South Sulawesi.

The container used is a green plastic bucket. The number of buckets used were 27 pieces with a capacity of 80 L. The water used was sea water from Takalar waters which had been sterilized using 10 ppm chlorine for 24 hours and given strong aeration then neutralized with sodium-thiosulfate (Na2S2O3) dose 3 ppm then allowed to stand for 3 hours. The salinity of seawater used in seed maintenance is 35 ppt. Each container was stocked with 20 white snapper seeds. The feed used was in the form of pellets with the composition of raw materials for each treatment as shown in Table 1, while the nutritional composition of the experimental feed was in Table 2.

Table 1. The composition of the raw materials is in each treatment

Raw Materials	Treatment feed (% dry matter)		
	A	B	C
Fish Flour	30	43	50
Shrimp Head Flour	9	9	9
Cornstarch	3	3	3
Soy Flour	24	15	14
Apkiran Noodles	12	10	10
Fine Bran	18	16	10
Fish Oil	2	2	2
Vitamins and Minerals	2	2	2

Table 2. The nutritional composition of the experimental feed

Test Feed	Ash	Fat	Protein	S. Rude	BETN
A	18.06	6.3	34.97	20.67	20
B	15.97	8.34	40.93	21.21	13.55
C	16.81	7.72	45.74	20.03	9.7

Description: The results of the analysis of the Lab. BRPBAPPP Examiner, Maros (2021)

All fractions are expressed in dry matter

The feed used is artificial feed with a predetermined composition in Table 1. and Table 2. The process of making feed begins with preparing all the raw materials, then the ingredients are weighed as needed and placed in a container in the form of a basin. All ingredients are mixed and then stirred until well blended, then fish oil, a mixture of vitamins and minerals are added to the dry ingredients mixture. After it is evenly mixed, warm water is added to the feed raw material mixture to form a dough/paste. The feed dough is stirred until it does not stick to the hands and then molded into pellets.

The feed in the form of pellets is spread evenly on a tray and dried in the sun to dry. The dried feed is put in a labeled plastic bag and stored in a dry place. Fish were fed 20-10% of fish biomass per day during the study.

In order to achieve the research objectives, white snapper fish were reared for ± 2 months. At the time of maintenance, the thing that needs to be

considered is the frequency of feeding. The frequency of daily feeding according to the treatment was twice per day, four times and six times per day. Weight measurement was carried out every two weeks to monitor body weight and survival of white snapper fry that were kept as well as to adjust the feed given.

The experimental design used was a factorial design with a completely randomized basic design. The first factor is the level of carbohydrates in the feed, namely; (1) The carbohydrate content of feed is 40%; (2) The carbohydrate content of feed is 35%; (3) The carbohydrate content of feed is 30%

Each carbohydrate level was repeated 3 times. The second factor is the frequency of each feeding; (1) Frequency of feeding twice per day; (2) Frequency of feeding four times per day; (3) Frequency of feeding six times per day.

Each treatment frequency of feeding was replicated 3 times, so that 9 treatment combinations were obtained, each was replicated 3 times so that 27 experimental units were obtained.

Observation

Total Digestibility of Feed

$$ADC\ Dry\ Matter(\%) = 100\ x\left[\left(\frac{Md}{Mf}\right)\right]$$

Description:

ADC is the coefficient of total digestibility of feed (dry matter)

Md and Mf respectively are the concentrations of the indicator Cr_2O_3 (% dry weight) in feed and feces

Survival

$$SR = \frac{N_t}{N_0}\ x\ 100$$

Information:

SR: Survival rate

N_t : Number of fish that lived at the end of the study (tail)

N_o : Number of fish at the beginning of the study (tail)

Data Analysis

The data were analyzed using variance analysis (ANOVA). If the results of the analysis prove that the treatment is significant, then continue with the W-Tukey test to determine the treatment that produces the best response.

Results and Discussion

Total Digestibility of Feed

The average total feed digestibility of barramundi fry (L. calcarifer) that consume feed with a combination of various levels of carbohydrates and feeding frequency is presented in Table 3. The results of the calculation of the total digestibility of the feed of white snapper fry ranged from 50.20 to 63.41 %. The results of the analysis of variance (ANOVA) showed that the interaction between carbohydrate levels and feeding frequency had a significant effect (Sig.<0.05) on the total digestibility of barramundi seed feed.

Table 3. The average total digestibility of white snapper fry feed at each treatment combination

Treatment	Total Digestibility of Average Feed (%) ± Elementary School		
	F	G	H
A	60.45 ± 1.35^{cde}	61.77 ± 0.39^{de}	63.41 ± 1.09^{e}
B	55.37 ± 0.32^{abc}	55.01 ± 1.10^{abc}	53.92 ± 0.00^{ab}
C	54.97 ± 0.29^{abc}	50.20 ± 5.19^{a}	56.39 ± 1.26^{bcd}

Description: Different superscript letters indicate a noticeable difference between the treatment combinations at a 95% confidence level (P<0.05).

Based on the results of the further test, W-Tukey showed that the AH treatment (40% carbohydrates and feeding frequency 6 times) was not significantly different from the AF and AG treatments, but descriptively in table 3. it can be seen that the highest total digestibility was in the AH treatment. The lowest total feed digestibility was obtained in the CG treatment (30% carbohydrates and feeding frequency 4 times) but was not significantly different from the BF, BG, BH and CF treatments. The interaction between carbohydrate levels and different feeding frequency on the total digestibility of barramundi seed feed is presented in Figure 1.

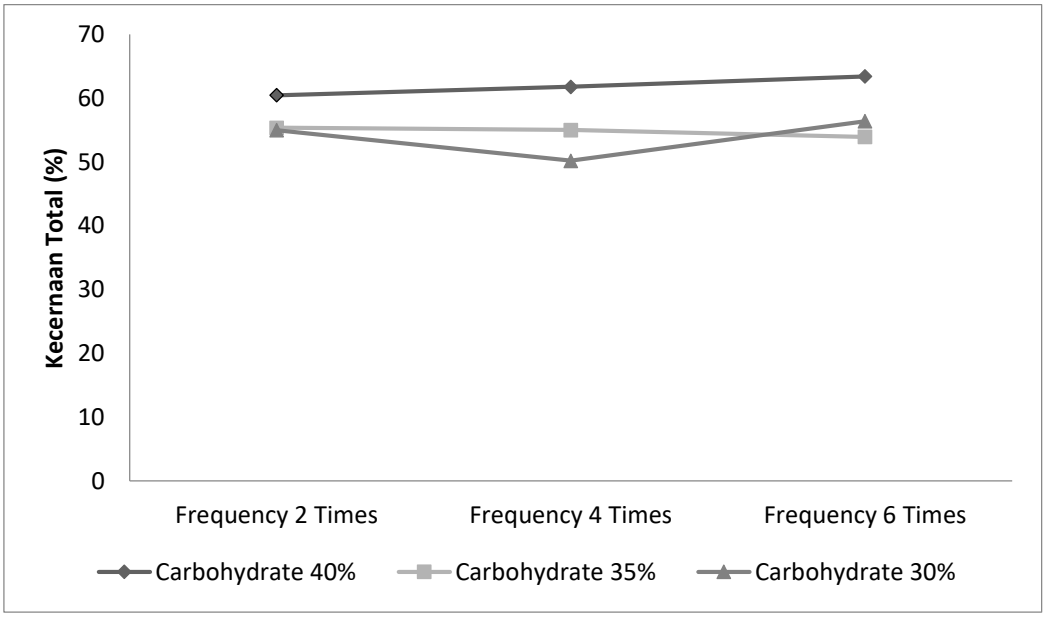

Figure 1. Interaction between carbohydrate levels and different feeding frequencies to total digestibility

The high total digestibility of barramundi seed feed in the AH treatment (carbohydrate 40% and feeding frequency 6 times) indicated that with carbohydrates and this frequency the fish could utilize the feed well so as to increase the total digestibility of the feed. This is because with a more frequent feeding frequency, the carbohydrates that enter are also little by little so that the snapper which is a carnivorous fish is able to digest its food because the enzyme concentration is in accordance with the substrate concentration. One of the factors that affect the digestibility of feed in addition to frequency and carbohydrates is the presence of enzymes and enzyme activity. According to Liao et al. (2015) the presence of enzymes and the activity of digestive enzymes affect the digestibility of feed in the digestive tract of fish. Where nutrients that have been digested and absorbed will be flowed by blood vessels to the liver and will be used for metabolic processes to meet energy needs (Arifin, 2015).

The low total digestibility of snapper seed feed resulted in the CG treatment (30% carbohydrate and 4 times feeding frequency), it is suspected that the 4 times feeding frequency is less effective because more feeding frequency will increase digestibility and provide opportunities for fish to get food at all times so that feed needs will always be met and prevent long-term starvation of fish. Zainuddin et al. (2014) also explained that a higher frequency of feeding was able to increase the utilization of carbohydrates for diabetics in humans.

Survival

The average survival of barramundi fry (L. calcarifer) consuming feed with a combination of various carbohydrate levels and feeding frequency is presented in Table 4. The results of the calculation of the survival of white snapper fry ranged from 73.33-83.33%. The results of the analysis of variance (ANOVA) showed that the carbohydrate content and frequency of different feeding and the interaction of the two had no significant effect (Sig.> 0.05) on the survival of barramundi fry.

Table 4. Average survival of white snapper fry at each treatment combination

Treatment	Average Survival (%) of elementary ±		
	F	G	H
A	73.33 ± 17.56	73.33 ± 16.07	78.33 ± 12.58
B	80.00 ± 5.00	83.33 ± 15.28	78.33 ± 12.58
C	76.67 ± 10.41	81.67 ± 12.58	80.00 ± 10.00

Description: The combination of treatments has no significant effect on the 95% confidence level (P>0.05).

The survival of barramundi fry in this study showed a relatively similar value for all treatments (73.33-83.33%). This is due to the nutritional content, level of feed consumption and water quality that support the survival of white snapper fry. The high survival rate is thought to be due to the nutrient content in the form of carbohydrates, proteins and fats which are suitable for the needs of white snapper seeds. Zainuddin et al. (2014) stated that optimal feeding is one way to maintain the survival and production of shrimp, where the availability of appropriate nutrients can maintain survival for the better. In addition, according to Mudjiman (2000) good nutrition in feed plays an important role in accelerating fish growth and maintaining survival. The level of feed consumption is also relatively the same as a source of energy and nutrients in maintaining the viability of white snapper fry. The availability of sufficient and appropriate food to meet the needs of fish in self-defense can support their survival (Aliyu et al., 2010). Water quality parameters as external factors are also in a reasonable range so as to produce a good survival rate. However, the death of fish in each container was thought to be due to the adaptation process to the test feed and cannibalism in some individuals. Kordi (2011) stated that white snapper is a wild predatory fish so that its food is in the form of small fish in the waters. The results of Khairul's research (2017) regarding the frequency of giving different feeds to white snapper fry resulted in a survival value of 66.67-90%

Conclusion

Based on this research, it can be concluded that the carbohydrate level of feed, frequency of feeding and the combination of the two significantly affect the total digestibility of barramundi seed feed with the best combination at a carbohydrate level of 40% and the frequency of feeding 6 times per day. The survival of white snapper fry gave the same response between treatments. From the observations made, it shows that the combination of 40% carbohydrate level and the frequency of feeding 6 times per day is the best combination that can be used in rearing white snapper fry (L. calcarifer, Bloch).

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