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Optimizing the growth of pangas catfish seeds through the addition of spirulina in feed

Optimalisasi pertumbuhan benih ikan patin melalui penambahan spirulina pada pakan

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ABSTRAK

Ikan patin (*Pangasius* sp.) merupakan komoditas penting di Indonesia. Permintaan yang tinggi di pasaran mengharuskan produksinya giat dilaksanakan. Penambahan spirulina sebagai suplemen pada pakan merupakan cara untuk meningkatkan pertumbuhan benih ikan patin agar produksi optimal. Tujuan penelitian adalah untuk menentukan jumlah spirulina yang berpengaruh terhadap pertumbuhan benih ikan patin yang ditambahkan ke dalam pakan pelet. Penelitian menggunakan Rancangan Acak Lengkap dengan 4 perlakuan dan 4 kali ulangan. Perlakuan 1 (pelet komersil 100g ditambah 3 g spirulina), perlakuan 2 (pelet komersil 100 g ditambah 5 g spirulina), perlakuan 3 (pelet komersil 100 g ditambah 7 g spirulina), perlakuan 4 (pelet komersil 100 g ditambah 9 g spirulina). Parameter yang diamati adalah pertumbuhan panjang dan berat, kelangsungan hidup, dan kualitas air (pH, suhu dan oksigen terlarut). Hasil studi menunjukkan bahwa penambahan spirulina 7 g memiliki pengaruh paling baik terhadap pertumbuhan dengan panjang 5,25 cm dan berat 6,74 g. Sedangkan yang terendah terjadi pada penambahan spirulina 9 g dengan panjang 4,08 cm dan berat 5,78 g. Mortalitas selama pemeliharaan tidak terjadi sehingga nilai kelangsungan hidup benih ikan patin 100% pada setiap pelakuan. Jadi penambahan spirulina sebagai suplemen pada pakan pelet berpengaruh terhadap pertumbuhan benih ikan patin, akan tetapi jika penambahan spirulina berlebih maka pengaruhnya tidak optimal.

Kata kunci: berat, kelangsungan hidup, *Pangasius*, sp., panjang, perlakuan

ABSTRACT

Pangasius catfish (*Pangasius* sp.) was an important commodity in Indonesia. High demand in the market requires production to be carried out actively. Adding spirulina as a supplement to feed was a way to increase the growth of pangasius catfish seeds for optimal production. The aimed of the research was to determine the effect of spirulina on the growth of pangasius catfish seeds which were added to pelleted feed. The research used a completely randomized design with four levels of treatment. Treatment 1 (100g commercial pellets + 3g spirulina), treatment 2 (100g commercial pellets + 5g spirulina), treatment 3 (100g commercial pellets + 7 g spirulina), treatment 4 (100g commercial pellets + 9g spirulina). The parameters observed were growth of length, weight, survival, and water quality (pH, temperature and dissolved oxygen). The study results showed that the addition of 7 g spirulina had the best effect on growth with a length of 5.25 cm and a weight of 6.74 g. Meanwhile, the lowest occurred when adding 9 g of spirulina with a length of 4.08 cm and a weight of 5.78 g. There was no mortality during maintenance so that the survival rate of pangasius catfish seeds was 100% in each treatment. So the addition of spirulina to feed has an effect on the growth of pangasius catfish. However, if ftoo much spirulina was added, the effect will not be optimal.

Keywords: lenght, *Pangasius*, sp., survival rate, treatment, weight

INTRODUCTION

Pangas catfish (*Pangasius* sp.) is one of the Indonesian people's favorite fish which is an important commodity. Not only does it taste delicious but there are also many other benefits. The nutritional quality index indicates that wild and cultivated pangas catfish, if consumed, can meet the body's needs and maintain health (Chakma et al., 2022). The potential pangasius catfish bones produced as gelatin (Mahmoodani et al., 2012). Production must be increased due to rising demand for pangas catfish in both domestic and international markets. Due to the high demand for this fish, intensive growing techniques are used.

In intensive cultivation, there are obstacles such as food, water, the environment and others. Fish cultivated at high stocking densities are easily attacked by disease and even die due to stress and are susceptible to infection (Cordero et al., 2016). As a result, supplements are crucial for the development of cultured fish. Adding the supplement *for Pangasius boucourti* increased growth, immunity, and illness resistance (Doan et al., 2016), (Meidong et al., 2017), (Puycha et al., 2017). Supplement used in aquaculture as immunostimulants (Song et al., 2014). Effects of supplemental meals on the development, survival, and health of young striped pangas catfish (Duc et al., 2020)

One dietary supplement that promotes fish growth is spirulina. *Spirulina platensis* possesses a number of qualities and nutrients that make it suited for use as functional meals, feed, and nutritional supplements (Andrade et al., 2018). The capacity of spirulina to enhance nile tilapia (*Oreochromis niloticus*) to haematological parameters, feed utilization, and growth (Siringi et al., 2021). When S. platensis is added to feed for growth and immunity in the farming of African catfish, it could function as a natural supplement (Purbomartono et al., 2022). The cyanobacterium spirulina has been researched as a possible source of bioactive peptides due to its high protein content and medicinal benefits (Ovando et al., 2016). The addition of 5% spirulina to feed can improve the growth quality of catfish (Jana et al., 2014), and also in female kenyi cichlids (*Maylandia lombardoi*), spirulina alters skin tone, giving it a bluish hue and a characteristic chroma value (Karadal et al., 2016). Skin color parameters were significantly improved by spirulina supplementation, improving the growth of juvenile caspian brown trout, carcasses composition and pigmentation (Roohani et al., 2019). Therefore, it is important to add spirulina to feed so that pangat catfish grow optimally and are not easily attacked by disease. The study aimed to determine the effect of adding spirulina on the growth of pangas catfish seeds which were added to pelleted feed.

MATERIALS AND METHODS

Experimental Design

The implementation begins with clearing the 16 aquariums measuring 30x30x30x30 cm, filled with water and left for 2 days, an aerator was installed and then 4-5cm pangas catfish seeds (the catfish seeds have been acclimatized so they don't get stressed). The research used a completely randomized design with four levels of treatment. Treatment 1 (100g commercial pellets + 3g spirulina), treatment 2 (100g commercial pellets + 5g spirulina), treatment 3 (100g commercial pellets + 7 g spirulina), treatment 4 (100g commercial pellets + 9g spirulina). This research was conducted in fisheries laboratory, Faculty of Agriculture, Muhammadiyah Palembang University. All water was replaced every ten days during fish sampling.

Pellet Making

The feed used was pellets mixed with dry spirulina in powder form. Spirulina flour was weighed according to the required amount, mixed with egg white in a bucket and stirred until smooth. 100 g pellets mixed with spirulina according to the treatment and stirred until smooth, dried by airing in a closed room for 30-60 minutes. Adlibitum feeding three times a day. Fish samples were taken every 10 days by taking 5 test fish from each aquarium and measuring their weight and length.

Data Collection

Absolute length growth (Effendie, 1979) using the formula :

$P = Pt - Po$

P = absolute length growth of study (cm)
Pt = length of fish at the end of study (cm)
Po = length of fish at the start of study (cm)

Absolute weight growth (Effendie, 1979) using the formula:
W = Wt-Wo
W = growth in absolute weight of fish kept (g)
Wt = fish weight at the end of the study (g)
Wo= fish weight at the start of the study (g)

Survival rate (Hanafiah, 2010) was calculated from the beginning to the end of the study using the formula:
SR =Nt-No x 100%
SR = survival rate (%)
Nt = number of fish alive at the end of the study (tails)
No = number of fish alive at the start of the study (tails)

Water Quality Parameters

Water quality monitoring was done to provide supporting data for the conducted investigation. pH (pH meter), dissolved oksygen (DO meter) and temperature (termometer) were measure every month experimental period.

Statistical Analysis

The effect of treatment on the observed parameters was analyzed using analysis of variance testing (ANOVA). When there were significant differences between the means, the least significant differences test was used to compare them (p 0.05). If the data analysis shows a real difference then proceed with the 95% Least Significant Difference (BNT) test.

RESULTS

Growth results have different values for each addition of spirulina. The results of length growth showed that the highest length was in the 7g spirulina addition treatment with a length of 5.25±0.3cm, while the lowest was in the 9g spirulina addition treatment with a length of 4.08±0.25cm (Figure 1).

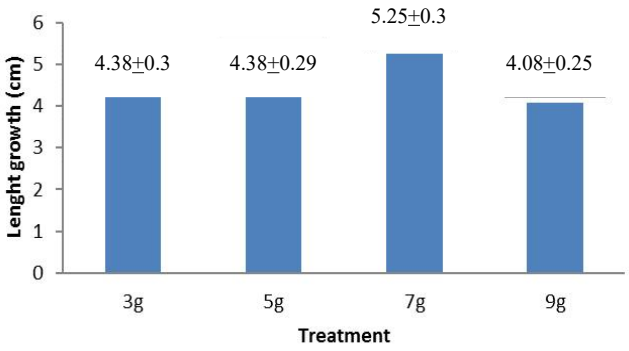

Figure 1. The absolute lenght growth value of pangas catfish seeds on the different treatment

Based on the results of the analysis of variance, it showed that the addition of spirulina had a significant effect on the absolute length growth of the catfish produced and was tested further with the smallest significant difference (BNT) (Table 1).

Table 1. BNT test addition of spirulina for length growth of pangas catfish seeds.

Treatment (g)	Average value of absolute length of fish (cm)	Test value of BNT 0.05=0.44
3	4.38	a
5	4.38	a
7	5.25	b
9	4,08	a

Based on the BNT results, it shows that the addition of 7g spirulina is significantly different from 3g, 5g, and 9g spirulina.

The weight growth results showed that the highest weight was in the 7g spirulina addition treatment with a weight of 6.74±0.57g , and the lowest was in the 9g spirulina addition treatment with a weight of 5.78+0.45g (Figure 2).

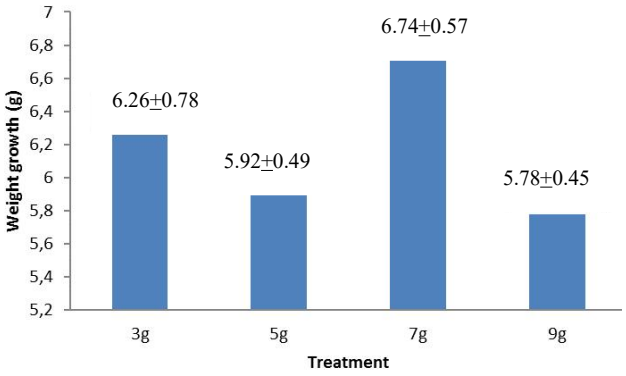

Figure 2. The absolute weight growth value of pangas catfish seeds on the different treatment

Based on the results of the analysis of variance, it showed that the addition of spirulina had a significant effect on the absolute weight growth of the catfish produced and was tested further with the smallest significant difference (BNT) (Table 2).

Table 2. BNT test addition of spirulina for weight growth of pangas catfish seeds.

Treatment (g)	Average value of absolute weight of fish (g)	Test value of BNT
		0.05=0.44
3	6.26	a b
5	5.92	a b
7	6.74	b
9	5.78	a

Based on the BNT results, it shows that the addition of 3g, 5g, and 7g spirulina is are significantly different from 9g spirulina.

The survival rate for each treatment showed a value of 100%, which means that no deaths occurred from the beginning to the end of the study. Based on the results of analysis of variance, it shows that the addition of spirulina has no real effect on the survival of the catfish seeds produced (Figure 3).

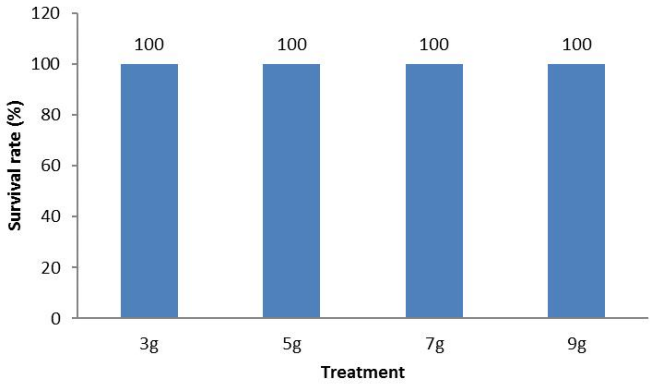

Figure 3. The survival rate value of pangas catfish seeds on the different treatment

The water quality in the maintenance media must be continuously monitored so that to maintain normal water quality, siphoning is carried out once a week (Table 3).

Table 3. Analysis Result of DO, pH and Temperature.

Parameters	Range
Dissolved oksygen (mg/L)	6.93-7.2
pH	6-71
Temperature (°C)	30-31

DISCUSSION

The results of the analysis of variance showed that additional spirulina feed had a real influence on the growth rate of length and weight of pangas catfish. Growth is the gradual alteration of a fish's weight, size, and volume of fish that are kept or treated. The physical manifestation of this growth throughout time is a change in the quantity or size of the cells that make up body tissue. The results of observations of the 7g treatment for increasing length and weight had the highest average values. This is because the protein content in the feed is sufficient to meet the nutritional needs of the fish and the fish are able to absorb nutrients well that no protein in the feed is wasted. Carnivorous fish such as pangas catfish require 30% more protein in their diet than land animals and birds because protein is used as an energy source compared to carbohydrates and fat (Cowey, 1995). Protein is needed for the formation of enzymes, hormones and proteins that make up plasma as an energy source, therefore fish can utilize energy for metabolism which is used for growth. Growth happens after energy from the diet has been consumed for normal metabolism, digestive processes, and supporting activities (Rostika et al., 2020). The main factor in growth is due to the accumulation of muscle protein as a result of which amino acids are distributed from food to the biomass that is being processed (Abdulrahman, 2014). Spirulina provides a variety of nutrients, particularly vitamins and minerals that may aid in promoting fish growth (Belay et al., 1996); (Jana et al., 2014); (Siringi et al., 2021). Spirulina increases protein and decreases fat content throughout the body due to increased protein and fat metabolism by spirulina (Roohani et al., 2019).

Based on the BNT results, it shows that the addition of 7g spirulina is significantly different from 3g, 5g, and 9g spirulina. This is because spirulina contains high protein reaching 65% and high vitamin content, this is used to trigger the accelerated growth process in fish, apart from that spirulina flour also contains carotenoids which are easily absorbed and used by the body (Vonshak, 1997). According to Estrada et al. (2001) and James et al. (2009) that spirulina has a

high protein content (600-700 g/kg dry weight), contains high levels of vitamin B12 and β-carotene (20 times more than carrots), minerals, essential amino acids (62%), and fatty acids

A strong source of protein for animal feed, spirulina algae also contains significant levels of vitamins and minerals (Duncan & Klesius, 2011). That is why the addition of 7 g of spirulina to pellets has the best value and is significantly different compared to other treatments. The addition of 3 g and 5 g of spirulina does not meet the protein needs of catfish so their growth is not optimal and growth is significantly different. Its because the catfish are in the aquarium so they cannot look for other food apart from the pellets they are given. The effect of utilizing spirulina meal as a food additive can increase growth significantly (inclusion level less than 4%), however, the effect is not clear when used as a feed ingredient (Li, Liu, & Zhang, 2022).

Treatment 9g produced the lowest growth among the other treatments. This happens because the dose of spirulina added to the feed is too high, causing the protein contained in it to exc eed the fish's needs. The addition of nutrients to feed has a maximum limit, meaning that if the nutrient content added to the feed is excessive then at a certain point it will not provide a change for the better. Not only that, the addition of 9g spirulina to pellet makes the pellets harder due to the amount of spirulina increase. The addition of more spirulina (9 grams) resulted in reduced fish appetite in consuming feed because the pellets were hard, this was due to the high binding power of the pellets in spirulina powder so that the pellets were like cement or petrified (Siringi et al., 2021), therefore the BNT results, it shows that the addition of 3g, 5g, and 7g spirulina is are significantly different from 9g spirulina.

The survival rate shows that all treatments have a high survival rate of 100%, which means that the survival of pangas catfish is very guaranteed. Such as the addition of 3 grams of spirulina which shows not the best results in growth but a 100% survival rate. This can happen because even if only a small amount (3 g) of spirulina is added to the pellet, it still has an effect on growth and survival. Spirulina has no cell walls so it is easily digested and absorbed, increasing appetite so that the volume of food consumed is large and the digestibility of nutrients increases so that fish health improves (Nandeesha et al., 1998) and (Ibrahem et al., 2013), however, the amount of protein content in the feed also has an influence. Report of Tongsiri et al. (2010) that spirulina can increase growth, all parts of the fish are quality, minimize mortality, and improve meat firmness. Besides that pellets are indeed fish food, so even without the addition of spirulina to the feed, fish survival will still be maintained as long as environmental quality can be controlled. The high survival rate of pangas catfish is influenced by adjustment to environmental conditions and provision of sufficient feed because survival is a chance value in a particular place. Factors like sex, age, reproductive activity, illnesses, water quality, stocking density, and nutrition have an impact on the survival rate (Muchlisin et al., 2016).

Apart from increasing the growth of spirulina, it also increases the brightness of the color of catfish. This can be seen from the difference in color before the catfish are fed and after they are fed with additional spirulina This is in accordance with research from James et al. (2009), Tongsiri et al. (2010) and Lu et al. (2003).

Water quality observations were used as supporting parameters throughout the study. Range of dissolved oksygen is 6,93-7,2 mg/L, according to (Effendi, 2003) level of dissolved oksygen for aquatic biota more than 4 mg/L. Range of pH 6-7,1 and the standar value of pH for cultivated activity around 6-8 (Kordi & Tancung, 2005), if less than that reduce the variety and species composition of the plankton community (Harmilia et al., 2022). Water temperature ranged from 30-31°C. Temperature affects the appetite of pangasius catfish. When the temperature reaches 30ºC or more, the fish eat greedily so growth increases, but when the temperature drops the fish have no appetite to eat, causing stunted growth (Khan et al., 2018). Low pH in cultivation activities can cause decreased growth and immunity, susceptibility to disease and high fish mortality.

CONCLUSSION

Based on the results of the review, spirulina added to feed can increase growth more

significantly. The addition of 7 g of spirulina to the feed resulted in the best and more effective growth of pangas catfish fry compared to other treatments.

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