Original Research Article

The use of fermented banana stems as a source of probiotics for the growth and survival of carp fry (Cyprinus carpio L.)

ABSTRACT

One of the obstacles that exist in this carp hatchery business is the lack of knowledge about the quality of feed that is not in accordance with the nutrients needed by fish. Feed quality that does not match the needs of the fish will lead to a low life-pass rate and fish growth rate. To overcome this, feed mixtures are made using fermented banana stems as a source of probiotics. The use of probiotics becomes an internal solution to produce optimal feed growth and efficiency, reduce production costs, and ultimately reduce environmental burdens due to waste accumulation in waters. The purpose of this study was to determine the right dose and effectiveness of adding probiotics from fermented banana stems mixed directly in carp seed feed on the growth and survival of carp fry. This study was designed using a complete randomised design (CRD). It consisted of 4 treatments and 3 repeats, for a total of 12 experimental units. The treatments used in this study were treatment A (control), treatment B (1.5 ml/100 g feed), treatment C (3 ml/100 g feed), and treatment D (4.5 ml/100 g feed). Based on the results of the study, the highest growth in absolute length and absolute weight and the highest survival occurred in treatment C (1.5 ml/100 g of feed).

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Keywords: banana stem, carp, growth, probiotics, survival

1. INTRODUCTION

Carp (*Cyprinus carpio*) is one type of biota that has high economic value and is widely cultivated for reasons of disease resistance and fast growth [1]. Carp have the advantage of containing high protein, being resistant to disease, being tolerant to temperature fluctuations, and being easy to cultivate [2].

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The increasing demand for carp has resulted in farmers carrying out intensive and even superintensive farming systems. This condition will certainly cause obstacles. One of the obstacles that exist in this carp hatchery business is the lack of knowledge about the quality of feed that is not in accordance with the nutrients needed by fish. Feed quality that is not in accordance with fish needs will cause a low life pass rate and fish growth rate [3].

Feeds are needed in addition to maintaining the survival of fish. Feed is also used to manage daily life and the subsequent growth of fish. So if the feed is less nutritious, growth will be hampered and will eventually affect production; thus, it can be concluded that every organism needs feed to carry out its activities [4]. To overcome this, feed mixtures are made using fermented banana stems as a source of probiotics. These materials are relatively cheap and easy to obtain in the surrounding environment.

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The use of probiotics is a solution to produce optimal feed growth and efficiency, reduce production costs, and ultimately reduce environmental burdens due to waste accumulation in waters [5]. Probiotics are good microbes that are beneficial and have a role in fish life. Probiotics are given in order to maintain the quality of the water in ponds, overcome disease attacks that will attack fish, increase feed efficiency in fish, and increase fish productivity so that fish can be harvested quickly.

Saselah & Mandeno [6] have applied probiotics from local ingredients, namely fermented banana stems, to increase the growth and survival rate of freshwater pomfret. With variations in probiotic dosing on feed: 1.5 ml/100 g feed, 3 ml/100 g feed, and 4.5 ml/100 g feed, and produced the best results at a dose of 4.5 ml/100 g feed. However, the application of this probiotic has not been found in carp rearing. This study aims to examine the use of fermented banana stems as a source of probiotic feed for carp fry.

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2. MATERIAL AND METHODS

2.1. Materials

The materials used in the study were carp fry, fresh water, pelleted feed, yeast tape, banana stems, molasses, and rice water. The tools used in the study were clear plastic containers, aeration hoses, aeration stones, blowers, sponges, scales, rulers, pH metres, thermometers, and DO metres.

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2.2. Experimental Design

This study used an experimental method and was designed using a Complete Randomised Design (RAL), with 4 treatments, and each treatment was carried out three times.Sothis study consists of 12 experimental units. The treatment carried out in this study was the difference in the dose of fermented banana stems as a source of probiotics mixed into feed in each treatment. The treatment applied refers to Saselah & Mandeno [6], which is as follows:
Treatment A: Control
Treatment B: 1.5 ml/100 g feed
Treatment C: 3.0 ml/100 g feed
Treatment D: 4.5 mL per 100 g of feed

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2.3. Research Procedure

Fermentation of Banana Stems

The fermented banana stems used in this study consisted of local ingredients such as yeast tape, banana stems, molasses, and rice water fermented for 7 days in a tightly closed or airtight container. According to Amarwati *et al.* [7], Enzymes produced from the fermentation process are able to improve nutrition, growth, and digestibility of crude fibre, protein, and other nutrients in feed.

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Application to feed

Feed application begins with weighing 100 g of feed for each treatment. Furthermore, each feed is given a probiotic solution by spraying it on the feed according to a predetermined dose. Treatment A is without a probiotic mixture or control; treatment B mixes probiotics. 1.5

ml/100 g feed, treatment C mixing probiotics at 3 ml/100 g feed, and treatment D mixing probiotics at 4.5 ml/100 g feed. The feed used in the study was PF 500 feed.

Seed Rearing

Seed rearing is carried out for 28 days. Feeding is done three times a day. The feed given to the seeds is feed that has been mixed with probiotics. Sampling of the weight and length of fish is carried out once every 7 days.

2.4. Research Parameters

Growth in Weight and Length

The parameters observed in the study were weight gain and absolute length. The growth of the fish's weight is measured using a scale with an accuracy of 0.01 g. Meanwhile, to measure the growth of length, it is measured using a ruler.

The growth of carp fry weight can be calculated using the following formulaWeatherley *in* Dewantoro [8]:

W= Wt-Wo

Annotation:
W = absolute weight growth (g)
Wt = final fish weight (g)
Wo = initial fish weight (g)

The growth of carp fry length can be calculated using the formula Effendie*in* Effendie *et al.*[9] as follows:

$$\mathbf{Lm=L_2 - L_1}$$

Annotation:
L = growth in absolute length (cm)
L_2 = final length of fish (cm)
L_1 = initial length of fish (cm)

Survival

One of the parameters observed in this study is the survival of carp fry. The survival rate of fish during maintenance is good. According to Sulastri[10], there are three levels to distinguish the level of fish survival: 1) Survival of more than 50% is classified as good; 2) 30–50% is classified as medium; and 3) less than 30% is classified as bad. The formula used to calculate the survival of carp fry uses the following equation [11] (Yustiani *et al.*, 2013).

SR= NT/N0 × 100 %

Annotation:
SR: Survival Rate (%)
NT: number of individuals at the end of the study (tail)
N0: the number of individuals at the beginning of the study (tail)

Water Quality

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Water quality is measured daily in the morning and evening. The measured water quality parameters are temperature, pH, and dissolved oxygen (DO).

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2.4. Data Analysis

The research data were analysed using diversity analysis (ANOVA) to determine the effect of treatment on research parameters. Further analysis was used by Duncan's multiple distance difference test to determine any differences between treatments. Data analysis was performed using SPSS software version 25.

3. RESULTS AND DISCUSSION

3.1. Absolute Weight Growth

The results of statistical analysis show that mixing probiotics in carp fry feed affects the growth of absolute weight in carp fry. The results of further tests using Duncan's multiple distance difference test showed that the treatment differed markedly from the control, except for the low-dose treatment of 1.5 ml per 100 g of feed.

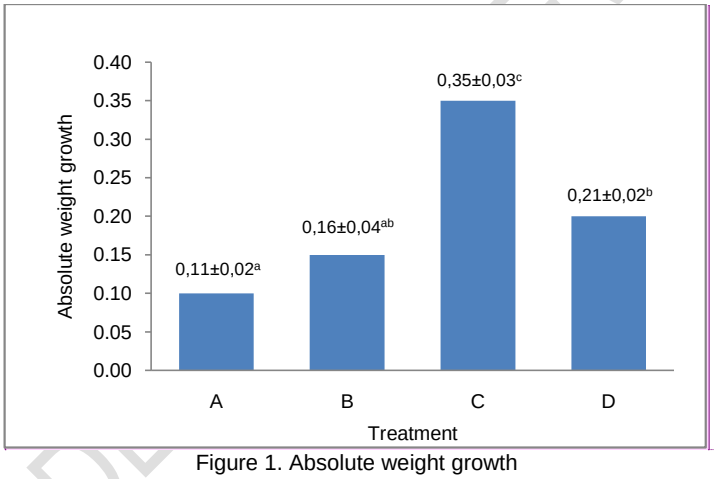

Figure 1. Absolute weight growth

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The absolute weight growth of carp fry during maintenance was highest in the probiotic mixing treatment dose of 3 ml/100 g feed, where the treatment was significantly different from other treatments. This shows that the best probiotic mixing of fermented banana stems based on absolute weight growth parameters is 3 ml/100 g feed.

The high growth of absolute weight of carp fry for 28 days of maintenance with feed mixed with fermented banana stem probiotics of 3 ml per 100 g of feed is caused by the mixing of probiotics, which is able to increase the digestibility of fish fry against the feed given. According to Sucipto & Prihartono [12], the increase in fish weight is related to the fish's ability to utilise and digest the feed given.

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3.2. Absolute Length Growth

The results of the diversity analysis showed that the treatment applied had a significant effect on the growth of the absolute length of carp fry. The results of further tests showed

that treatment C (3 ml/100 g feed) was significantly different from other controls and treatments, where treatment C obtained the highest average value of absolute length growth. This shows that mixing probiotics in carp fry feed as much as 3 ml per 100 g of feed can increase absolute length growth to the maximum. This shows that the dose in the treatment is in accordance with the needs of carp fry, so that feed absorption and feed digestion are better. The right dose of probiotics that cause the growth of carp fry is good.

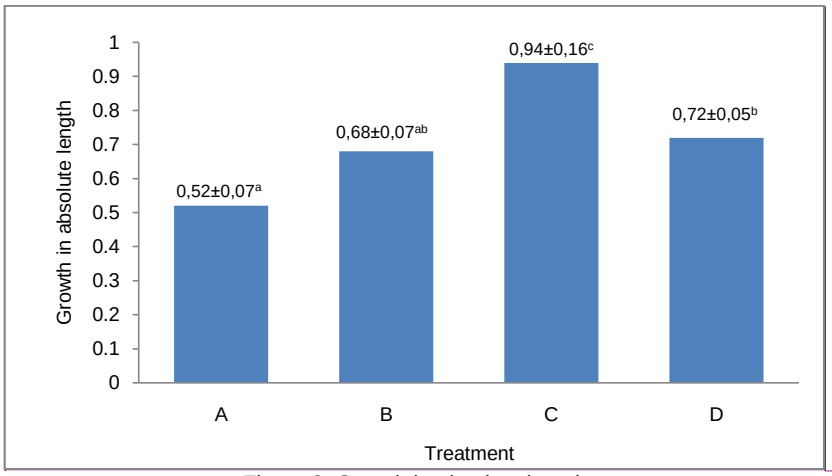

Figure 2. Growth in absolute length

After reducing the energy required to metabolise the feed and the energy present in the faeces, more energy from the feed is available for growth [13].

3.3. Survival Rate

The results of statistical analysis showed that the treatment of mixing probiotics in carp feed had a significant effect on the survival rate of carp fry during rearing. The results of Duncan's multiple distance difference test showed that the treatment applied was significantly different from the control or without probiotic mixing. Of the three treatments applied, mixing probiotics with 3 ml/100 g of feed gave the highest survival rate of 80% and was significantly different from other treatments (Figure 3). The *survival rate* of fish above the range of 50% is good, while 30–50% is in the medium category, and less than 30% is categorised as not good [10]. Based on this, it can be said that survival in all treatments is still relatively good.

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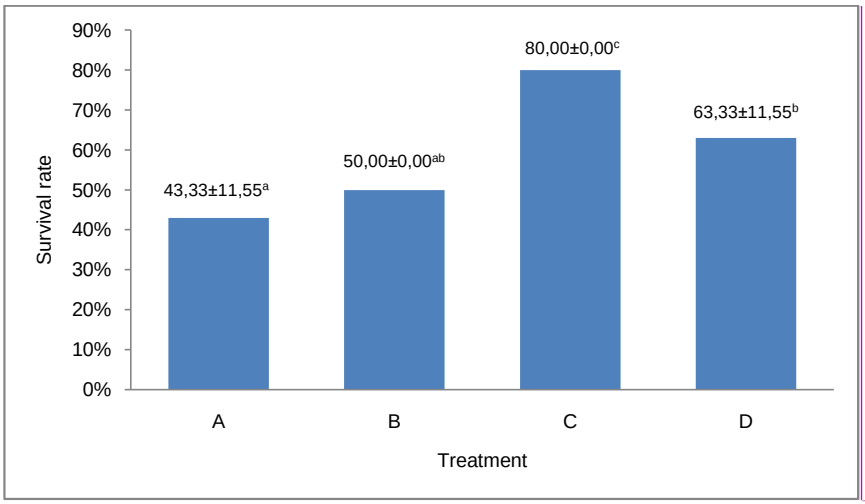

Figure 3. Survival rate

This study showed that mixing probiotics beyond the dose of 3 ml/100 g of feed no longer increased the survival of carp fry and even tended to decrease it (Figure 3). This shows that a probiotic mixing dose of 3 ml/100 g of feed is the optimal dose to increase the survival of carp fry.

Water quality

The results of water quality measurements obtained during the study are still included in the optimal range of carp maintenance to support growth and survival. This shows that water quality parameters are not affected by the feed used, so they do not negatively affect the growth and survival of carp fry during rearing.

Table 1. Water Quality Measurement Results of Each Treatment

Parameter	Treatment				Eligibility Resources
	A	B	C	D	
Temperature (°C)	21,4-22,2	21,6-22,2	21,5-22,3	21,5-22,3	25-32 [14]
pH	7,58-7,61	7,51-7,77	7,45-7,80	7,52-7,66	6,5-8,5 [15]
DO (ppm)	5,09-5,55	5,43-5,80	5,37-5,51	5,09-5,50	>5 [16]

Based on water quality data obtained during research on all treatments, pH 7.51–7.80 and dissolved oxygen (DO) 5.09–5.80 were found to be within the optimal range according to feasibility sources. Water quality figures for pH and DO that are still in the optimal range do not inhibit the growth and survival of carp fry. While in the temperature range obtained during the study, which is around 21.4–22.3 °C, this temperature is relatively low. This is because the location of the research location is in a highland area, so it has a lower or colder temperature than lowland areas.

The temperature obtained during the study ranged from 21.4 to 22.3, classified as low. Makkaminan [14] reported that the optimal temperature for carp rearing is around 25–32 °C.

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However, the temperature obtained during the study can still be tolerated by carp. This is in line with the statement of Nugraha*et al*. [17] that aquatic organisms such as fish and shrimp can live well in the temperature range of 20–30 °C. The same thing is also that a good temperature range for fish maintenance is 20–25 °C [18].

The pH value during the study ranged from 7.45–7.80; the pH range was classified as good and feasible for the life of the carp. According to Rahmadinah[19], a good pH range for the maintenance of carp fry is in the range of 7.4–7.7. Acidity (pH) can affect productivity in a body of water [20].

The results of dissolved oxygen (DO) measurements during the study showed results of 5.09–5.80 mg/ll dissolved oxygen levels, which were classified as good according to Cahyono *et al.*(2011), who found that a good dissolved oxygen range for carp rearing is around >5 mg/ll. Oxygen is one of the most important factors in an aquatic ecosystem [21].

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4. CONCLUSION

Giving probiotics made from local ingredients (banana stems fermented by yeast tape) has an influence on growth and survival. The best dose obtained from this study was the mixing of probiotics as much as 3 ml per 100 g of feed, where carp fry were produced with an absolute weight growth of 0.35 g per head, an absolute length growth of 0.94 cm per head, and a survival rate of 80%.

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