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Evaluation of Kecipir Seed Extract (*Psophocarpus tetragonolobus* L.) in Feed on the Growth Performance of Catfish (*Clarias* sp.)

Evaluasi Ekstrak Biji Kecipir (*Psophocarpus tetragonolobus* L.) Pada Pakan Terhadap Kinerja Pertumbuhan Ikan Lele (*Clarias* sp.)

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Abstract

Efficiency of nutrient utilization and feed supply costs needs to be done using kecipir seeds to support fish growth. This study aims to determine the optimal dose of the addition of kecipir extract to feed on catfish growth performance. Catfish (7.44±0.16 g) were stocked 1 fish/L in a bucket with a volume of 20 L. This study used a completely randomized design consisting of four treatments of kecipir seed extract dosage, namely 0 ml/kg feed (P1), 10 ml/kg feed (P2), 30 ml/kg feed (P3), and 50 ml/kg feed (P4), which were repeated four times. The growth performance parameters observed were absolute length (Pm), absolute weight (Wm), feed consumption rate (TKP), feed conversion ratio (FCR), daily growth rate (SGR), and survival (SR). Data were analyzed using one-way analysis of variance and continued with Duncan's Multiple Range Test with 95% confidence interval ($p<0.05$). Catfish fed with P4 feed produced the best growth performance, including Pm of 4.32 ± 0.51 cm, Wm of 15.75 ± 2.75 g, SGR of 52.49 ± 9.18%/day, and FCR of 1.21 ± 0.09, although not significantly different from the P3 feed treatment. This study concluded that the addition of kecipir seed extract to the feed improved the growth performance of catfish with an optimal dose of 50 ml/kg feed.

Keywords: *Soybean seed, catfish, growth*.

Abstract

Optimizing nutrient utilization and minimizing feed costs are essential for supporting fish growth, with winged bean presenting a viable solution. This study aimed to determine the optimal dosage of dietary winged bean extract supplementation to enhance the growth performance of catfish. Catfish (mean weight 7.44 ± 0.16 g) were stocked at a density of 1 fish/L in 20 L containers. A completely randomized design was utilized, comprising four treatment groups based on the dosage of winged bean seed extract: 0 ml/kg feed (P1), 10 ml/kg feed (P2), 30 ml/kg feed (P3), and 50 ml/kg feed (P4), with each treatment replicated four times. Growth performance parameters included absolute length (Pm), absolute weight (Wm), feed intake (FI), feed conversion ratio (FCR), specific growth rate (SGR), and survival rate (SR). Data were analyzed using a one-way ANOVA, followed by Duncan's Multiple Range Test at a 95% confidence level ($p<0.05$). Catfish fed P4 exhibited the best growth performance, with Pm of 4.32 ± 0.51 cm, Wm of 15.75 ± 2.75 g, SGR of 52.49 ± 9.18%/day, and FCR of 1.21 ± 0.09, though insignificantly different from P3. This study concluded that 50 ml/kg feed of winged bean seed extract optimally enhances catfish growth performance.

Keywords: *Catfish, growth, winged bean seeds.*

1. Introduction

Catfish is one of the freshwater fish that is widely cultivated and consumed in Indonesia. Catfish production increased from 993,653.04 tons in 2020 to 1,041,422.43 tons in 2021 (KKP, 2022). This shows that the demand for catfish has increased and has a high opportunity if it is used as a business in the fisheries sector. Catfish is a fishery commodity that is widely cultivated in freshwater and is also widely liked by the wider community because it tastes savory and is easy to process. Catfish has many advantages compared to other freshwater fish, such as easy maintenance, fast growth, distinctive meat flavor, and high feed efficiency (Agus *et al.,* 2021). Catfish is also one of the Ministry of Marine Affairs and Fisheries' (KKP) superior freshwater commodities to increase production (Seviana *et al.,* 2023).

The fish farming process requires the need for feed in the fish hatchery business. Feed that meets the nutrient needs of fish can increase the growth of fish seeds to a ready-to-sell size (Madinawati *et al.,* 2011 in Rihi, 2019). Feed in aquaculture activities is generally commercial feed which consumes around 60-70% of the total production costs incurred (Arief *et al.,* 2014). The increasing price of feed due to the use of imported raw materials in the form of fishmeal and soybean flour makes

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it more difficult for farmers to reduce production costs (Abidin *et al.,* 2015). This is why feed is still a problem for some fish farmers in Indonesia. The increase in demand for catfish causes catfish production to also increase, while the increasing price of commercial feed makes it increasingly difficult for farmers to reduce production costs. This requires the supplementation of *feed additives* such as kecipir to increase feed nutrient utilization, so as to accelerate the growth of catfish fry to consumption size and increase feed utilization efficiency.

Kecipir is a plant in the tropics that can be utilized every part of the plant. Based on the statements of several previous studies, the seed extract of kecipir is thought to contain many active ingredients, especially flavonoids, which are useful for antioxidants and increasing fish growth. According to Khudhori (2016), feed added with antioxidants in the form of flavonoids has increased growth because flavonoids are known to play a positive role in fish metabolism and can increase nutrient utilization which leads to increased fish growth. The kecipir plant is known to contain many peptide, phenolic, and flavonoid compounds (Singh *et al.,* 2019). According to Lestari *et al.* (2018), the potential of kecipir fruit extract after being tested for phytochemical *screening* contains saponins, flavonoids, polyphenols, steroids, and also terpenoids. The results of phytochemical screening indicate that the kecipir fruit can be used as a source of antioxidants because it contains flavonoid compounds. According to the opinion of Bassal *et al.*, (2020), the seeds of kecipir are thought to contain flavonoids and have antioxidant activity.

Based on this background, research is needed on alternative media such as pellets added with kecipir seed extract, as a *feed additive* to increase catfish growth. Based on this description, this study was conducted to determine the effect of the addition of extracts from old kecipir seeds with the *coating* method on pellet feed for catfish seeds related to the best ratio for catfish seeds as an alternative feed medium in order to get optimal nutrients and accelerate the growth of seed size to consumption size.

2. Materials and Methods

2.1. Time and Place

This research was conducted during 30 days of rearing in July-August 2024. The location of catfish rearing was located in Sanggrahan, Wates, North Magelang District, Magelang City, Central Java. The activity of making kecipir seed extract was carried out in the Integrated Laboratory of Tidar University.

2.2. Preparation of Containers

The maintenance containers used were 16 20 L plastic buckets. The buckets to be used were washed thoroughly and then dried. Furthermore, the bucket is labeled as a marker for each treatment. After that the bucket is positioned according to the maintenance pattern that has been designed and then filled with 15 liters of water.

2.3. Preparation of Kecipir Seed Extract

The preparation of kecipir seed extract is by pressing and maceration carried out at the Integrated Laboratory of Tidar University through several stages, among others:

1. Kecipir seeds are washed thoroughly and then dried in the sun until the moisture content is around 10%. This drying aims to prevent the raw material from being overgrown with mold or unwanted microorganisms.
2. The dried kecipir seeds were oven for 3 hours at a temperature of 70^{o}C. After roasting, the seeds are pulverized until flour is obtained, then sifted with a 60 mesh sieve or 0.25 mm.
3. The flour was then macerated with 96% ethanol for 6 days in a ratio of 1:5, during the soaking of flour in ethanol, periodic stirring was carried out. After 6 days of soaking, filtering was carried out and the filtrate was taken.
4. The soaked powder was filtered with filter paper to obtain liquid extract. *Rotary evaporator* was used to evaporate the liquid extract at 130 rpm at 89-90ºC for 150 minutes to obtain thick ethanol extract.

2.4. Fish Adaptation

The catfish used in this study were fry size catfish with a length of 10 cm and an average weight of± 7 g in a healthy condition, no defects, no wounds. The research container used a 20 L used bucket filled with 15 L of water and 10 catfish seeds per container. The containers used were 16 pieces with a total of 160 catfish seeds. Catfish were adapted for 3 days. During adaptation, the test fish were given commercial pellets *at satiation* with a frequency of twice a day, namely morning and evening. After adaptation, the length and body weight of the test fish were measured. To maintain the water quality, water was siphoned and changed.

2.5. Mixing Extract with Feed

Kecipir seed extract for each dose was dissolved in 200 ml of water, along with 1 egg white for a frequency of 1 kg of pelleted feed. Egg white is used as an adhesive for the feed pellets. Each dose of kecipir seed extract that has been dissolved in water and egg white is then mixed in the feed pellets evenly until it changes color. This mixing is done by *coating* method. Feed that has been mixed with kecipir seed extract is heated in the oven at 70^{o}C for 3 hours. The heated feed is then stored in a closed place.

2.6 . Feeding

Feeding in this study uses the *at satiation* method where fish are fed until the fish feel full. Feeding *at satiation* in order to meet the amount of feed needed by fish, because it is given until satiety is reached.

2.7. Water Quality Measurement

Temperature, pH, and DO measurements were taken in the morning and evening *in situ*.

2.8 Research Design

The research design used in this research is an experimental design, namely a Completely Randomized Design (CRD) with four treatments (P) including without the provision of kecipir seed extract, and four replicates (U), which are randomized freely in the research container. The treatment applied in this study is the provision of kecipir seed extract with different concentrations, namely:

- P1 : Commercial feed without kecipir seed extract 0 ml/kg feed
- P2 : Commercial feed with kecipir seed extract 10 ml/kg feed
- P3 : Commercial feed with kecipir seed extract 30 ml/kg feed
- P4: Commercial feed with 50 ml/kg feed of kecipir seed extract.

2.9. Data Analysis

2.9.1. Absolute length growth

Absolute Length Growth was calculated using the formula of Windarto *et al.* (2019), as follows:

$$L = Lt - Lo$$

Description:
L = Absolute length growth (cm)
Lt = Average length of fish fry at the end of rearing (cm)
Lo = Average length of fish fry at the beginning of rearing (cm)

2.9.2. Absolute Weight Growth

Absolute weight growth (W) was calculated using the formula of Windarto *et al.* (2019), as follows:

$$W = Wt - Wo$$

Description:
W = Absolute weight growth (g)
Wt = Average weight of fish fry at the end of rearing (g)
Wo = Average weight of fish fry at the beginning of rearing (g)

2.9.3. Survival Rate

The survival rate is expressed as the percentage of organisms alive at the beginning and end of the study and is formulated (Fadhil, 2013):

$$SR = \frac{Nt}{No} \times 100\%$$

Description:
SR = Survival rate (%)
Nt = Number of fish alive at the end of observation (fish)
No. = Number of fish alive at the beginning of observation (fish)

2.9.4. Specific Growth Rate

According to Zonneveld *et al*. (1991) *in* Wicaksana *et al.* (2015), the specific growth rate of fish is calculated using the formula:

$$SGR = \frac{Ln\ Wt - Ln\ Wo}{T} \times 100\%$$

Description:
SGR = Specific growth rate (% weight per day)
Wt = Fish weight at the end of rearing (g)
Wo = Fish weight at the beginning of rearing (g)
T = Maintenance time (days)

2.9.5. Feed Conversion Ratio

According to Effendie (1997) *in* Wicaksana *et al.* (2015), the feed conversion rate can be calculated by the formula:

$$FCR = \frac{F}{(Wt + D) - Wo}$$

Description:
FCR = Feed conversion rate
F = Total feed consumption (g)
Wt = Total weight of fish at the end of the study (g)
Wo = Total weight of fish at the beginning of the study (g)
D = Total weight of fish that died during the study (g)

2.9.6. Feed Consumption Rate

The amount of feed consumed is calculated from the amount of feed given minus the remaining feed at each feeding and summed up during the rearing period (Setiawati, 2008 *in* Wicaksana *et al.,* 2015).

2.8.7. Statistical Data Analysis Test

The data obtained in this study were analyzed using statistical analysis of variance or one-way *Analysis of Variance* (ANOVA) and F test at 95% confidence interval with an error level of$\propto$ = 0.05 in accordance with a complete randomized design (RAL) using Microsoft Excel.

Table 1.
ANOVA Calculation

Source of Diversity	Free Degree	Sum of Squares	Center Square	F-Count
Treatment	t-1	JKP	KTP =	F=KTP/KTG
Error	t(r-1)	JKG	KTG = JKG/dbg	
Total	tr-1	JKT		

Source: susilawati, 2015.

Hypothesis testing proposed in this study is formulated as follows:
H0 : $\mu 0 = \mu 1$
: The addition of kecipir seed extract to feed has no effect on the growth performance of catfish fry.
H1: $\mu 0 \neq \mu 1$
: The addition of kecipir seed extract to feed affects the growth rate of catfish fry.
The hypothesis for the effect of the treatment is:
H0 : The dose of kecipir seed extract in feed does not affect the growth performance of catfish fry.
H1 : There is at least one treatment of the dose of kecipir seed extract in feed that affects the growth rate of catfish.
Description:
$\mu 0$: Average percentage of the control treatment or without the addition of kecipir seed extract.
$\mu 1$: The average percentage of treatments with the addition of kecipir seed extract of 10 ml, 30 ml, and 50 ml.

After the data is calculated with an error rate of$\propto$ = 0.05, then compare the results of F count and F table with the following conclusions:
a. If F count> F table with 95% confidence interval error level α = 0.05 then reject H_o or accept H_1 which means the provision of kecipir seed extract has a real effect on catfish growth.
b. If F count < F table with 95% confidence interval error level α = 0.05, then accept H_o and reject H_1 which means that the provision of kecipir seed extract has no significant effect on catfish growth.

If the calculation of the analysis of variance obtained at least one treatment result that is significantly different (P <0.05), it will be further tested using the DMRT (*Duncan Multiple Range Test*) further test to see the difference between treatments with a 95% confidence interval error level α = 0.05. The calculation formula for the DMRT (*Duncan Multiple Range Test*) test according to Susilawati (2015) is as follows:

$$DMRT\alpha = R\alpha\ (p.dbg)\ .\ \sqrt{KTG/r}$$

Description:
α = 5% real level
R = Distance value
P = Two-treatment rank distance
dbg = Error free degree
KTG = Mean square of error
r = Repeat

3. Results and Discussion

3.1. Absolute Length Growth

Based on Figure 1, the highest and best catfish length growth results were obtained in the P4 treatment with an average length of 4.32 ± 0.51 ^{a} cm, followed by the P3 treatment with an average of 4.09 ± 0.37 ^{ab} cm and P2 with an average of 3.64 ± 0.30 ^{b} cm. The lowest catfish length growth is in the P1 treatment with an average of 2.31 ± 0.13 ^{c} cm.

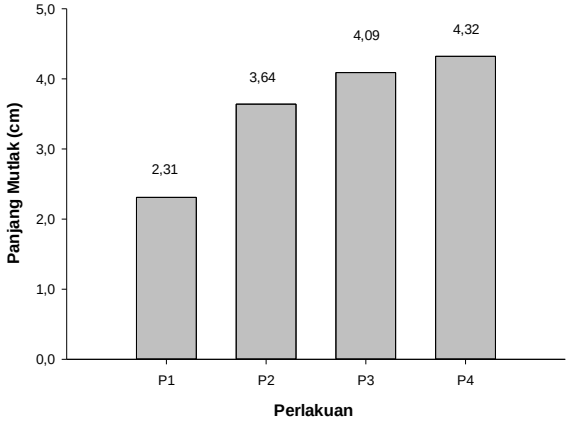


Figure 1. Results of Absolute Length Analysis (cm) of Catfish

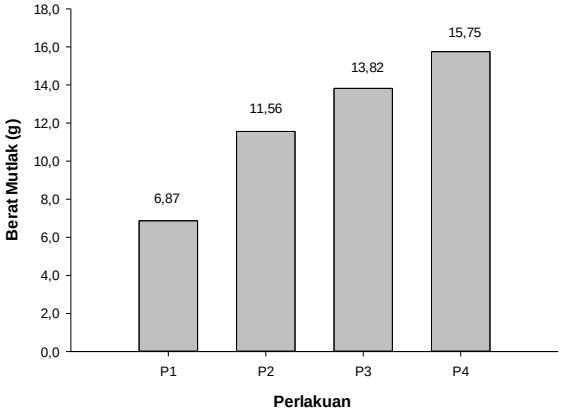


Figure 2. Results of Absolute Weight Analysis (g) of Catfish

The results of data analysis showed that the absolute length growth of catfish in the P1 treatment was significantly different from the P2 treatment, feeding in the P2 treatment was not significantly different from the P3 treatment, and feeding in the P3 treatment was significantly different from the P3 treatment.

Based on the statements of some previous research results, the extract of kecipir seeds is thought to contain many active ingredients, especially flavonoids, which are useful for antioxidants and increasing fish growth. As stated by Khudhori (2016), feed added with antioxidants in the form of flavonoids has increased growth because flavonoids are known to play a positive role in fish metabolism and can increase nutrient utilization which leads to increased fish growth.

In addition to flavonoids, one of the active ingredients contained in kecipir is polyphenols, which can reduce fat content. Polyphenol active ingredients are also found in cinnamon leaf extract. In accordance with the statement of Rolin *et al.* (2015), polyphenolic compounds will inhibit the formation of triacylglycerol / triglycerides which are the main deposits of fat in the fish body. It is suspected that with its role that can reduce fat content, it has the potential to improve the growth performance of catfish (*Pangasianodon hypophthalmus*) through the mechanism of protein *sparring effect*, namely basal energy needs can be met by fat and carbohydrates, so that energy from protein can be used for growth.

3.2. Absolute Weight Growth

Based on the results of the analysis in Figure 2, the highest and best catfish weight growth results were obtained in the P4 treatment with an average of 15.75 ± 2.75 ^{a} g, followed by the P3 treatment with an average weight of 13.82 ± 1.51 ^{ab} g, and P2 treatment with an average weight of 11.56 ± 1.74 ^{b} g, while the lowest average weight growth results were in the P1 treatment with a weight of 6.87 ± 0.50 ^{c} g. The P4 treatment had better relative growth. This indicates that in the P4 treatment the test fish experienced better relative growth. The results of the analysis of catfish weight growth to determine the effect of different doses of treatment with the addition of kecipir seed extract on fish weight growth then continued with the *One Way* ANOVA test.

The results of data analysis showed that the absolute weight growth of catfish showed that feeding in the P1 treatment was significantly different from the P2 treatment, feeding in the P2 treatment was not significantly different from the P3 treatment, and feeding in the P3 treatment was not significantly different from the P4 treatment.

Feeding with the addition of kecipir seed extract significantly affects the weight growth of the test fish, seen from the ANOVA test results where the results of P <0.05. This happens, because of the active ingredients in the kecipir, namely saponins, flavonoids, polyphenols, steroids, tannins, triterpenoids, and terpenoids. According to the discussion shown in the absolute length growth.

According to Linayati *et al.* (2021), stated that the antibacterial content in flavonoids can stabilize the intestines by suppressing the growth of unfavorable bacteria so as to increase the growth of organisms. According to Robinsson (1991) *in* Utami (2009), flavonoid active compounds function as hormonal controls on growth that can stimulate the *proximal pars distalis* gland and secrete growth hormone (somatotropin). Somatotropin hormone can stimulate growth and metabolism, increase feeding response and prevent liver damage (Zairin 2003 *in* Utami 2009).

3.3. Feed Consumption Rate

Based on the results of the *One Way* ANOVA test, Fhitung<Ftabel 5% (2.34<3.49) with 95% confidence interval and error rate α = 0.05, thus rejecting H1 or accepting H0. This means that the addition of kecipir seed extract to the feed does not significantly affect the level of feed consumption in catfish. The results of the ANOVA test analysis of catfish feed consumption levels have no effect, so there is no need to do further DMRT (*Duncan Multiple Range Test*) test.

The provision of kecipir seed extract in this study did not significantly affect the level of feed consumption, because it was thought that there was no palatability or response that could attract catfish appetite. In accordance with the statement of Suprayudi *et al.* (2013), palatability or response to a feed is influenced by several factors, including the condition of the feed which includes the shape, size, color, taste, and aroma of the feed.

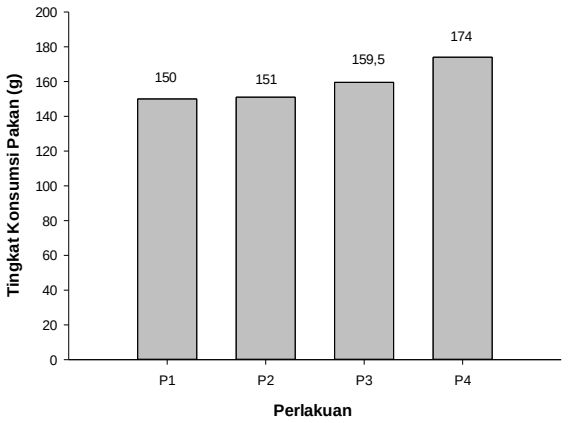
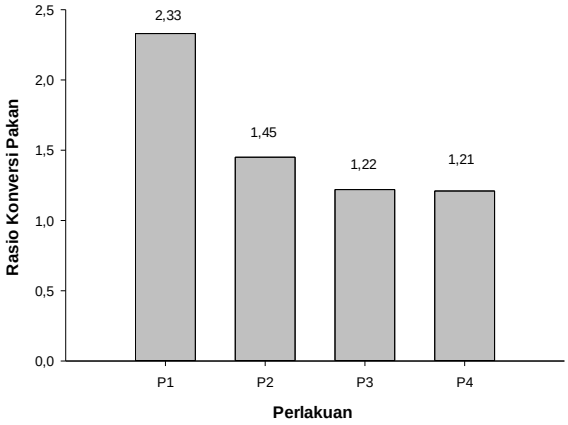


Figure 3: Results of Catfish Crime Scene Analysis

According to Usman *et al.* (2014), the level of feed consumption in fish is influenced by nutrient factors and feed palatability, environmental factors (water), and fish behavior factors. Environmental conditions or water quality during fish rearing is quite optimum for fish growth, so the main cause of low feed consumption rates is the feed palatability factor. Houlihan *et al.,* (2001) *in* Abidin *et al.,* (2015) mentioned, that the physical properties of feed can be influenced by the process of making feed, such as the use of temperature and pressure, although the most influential factor is the condition of the raw materials used.

3.4. Feed Conversion Ratio (FCR)

Based on the results of the analysis in Figure 4, the best average was obtained in treatment P4 with an average FCR of catfish of 1.21 ± 0.09 ^{a}, followed by treatment P3 with an average of 1.22 ± 0.04 ^{ab}, treatment P2 with an average of 1.45 ± 0.19 ^{c}, and the lowest treatment was found in treatment P1 which was 2.33 ± 0.05 ^{d}.



Results of Catfish FCR Analysis

Based on the results of the *One Way* ANOVA test analysis, Fhitung>Ftabel 5% (88.69>3.49) with a confidence interval of 95% and an error rate of α = 0.05, so it can reject H0 or accept H1. This means that the addition of kecipir seed extract to the feed has a significant effect on the feed conversion rate in catfish so that it can be continued for DMRT (*Duncan Multiple Range Test*) testing with a confidence level of 95%.

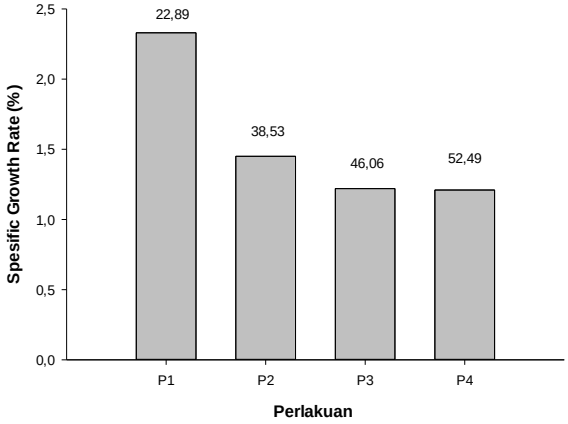
The results of Duncan's further test showed that feeding in treatment P1 was significantly different from treatment P2, feeding in treatment P2 was significantly different from treatment P3, and feeding in treatment P3 was not significantly different from treatment P4.

The best FCR value was obtained in the P4 treatment with an FCR value of 1.21 ± 0.09 ^{a}, although not significantly different from the P3 treatment (1.22 ± 0.04 ^{ab}). This is because the provision of kecipir seed extract on catfish FCR can increase the absorption and utilization of nutrients in the feed given, so that the provision of kecipir seed extract becomes efficient for catfish growth. In accordance with the statement of Kurniawan *et al.*, (2019), a good FCR value is between 0.8-1.6. According to Ardita (2015), the lower the FCR value, the more efficiently the fish utilizes feed, so that energy can be used for the growth process. In line with the opinion of Arief *et al.* (2014), the best level of feed utilization efficiency will be achieved at the lowest feed conversion calculation value. According to Fanani *et al.* (2018), the FCR value is a reference to the amount of feed that can be utilized by fish to add body weight. The lower FCR value indicates that the feed is more efficient to support fish growth.

Based on the results of the study, P4 and P3 treatments were not significantly different but significantly different from P2 treatment. The P2 treatment was significantly different from the P1 treatment. Although the provision of kecipir seed extract is not significantly different from the level of feed consumption because Fhitung <Ftabel 5%, but the FCR obtained is better than the treatment P1 (0 ml / kg feed). This indicates that although the feed consumption is the same, the utilization of nutrients and the growth of length and weight of catfish is better given the kecipir seed extract. The efficiency of fish enlargement efforts can be determined by calculating feed conversion. Environmental conditions, quality and quantity of feed and fish conditions affect fish growth and have a relationship with the high and low feed conversion produced (Niagara, 1994 *in* Madinawati *et al.,* 2011).

3.5. Specific Growth Rate (SGR)

Based on the results of the analysis in Figure 5, it was found that the SGR of catfish with the best average was in the P4 treatment with a value of 52.49 ± 9.18 ^{c} % / day, followed by P3 treatment with an average of 46.06 ± 5.03 ^{bc} % / day. The P2 treatment obtained an average of 38.53 ± 5.78 ^{b} % / day and the lowest average was obtained in the P1 treatment which was 22.29 ± 1.68 ^{a} % / day. Then, the results of the catfish SGR analysis continued the *One Way* ANOVA test.



Results of SGR Analysis (%/day) of Catfish.

Based on the results of the *One Way* ANOVA test on the SGR value of catfish, the value of Fcount>Ftabel 5% (17.83>3.49) with a confidence interval of 95% and an error rate of α = 0.05, thus rejecting H0 or accepting H1. This means that the addition of kecipir seed extract to the feed has a real effect on the specific growth rate of catfish, so it can be continued for DMRT (*Duncan Multiple Range Test*) testing with a 95% confidence level.

Based on the results of the Duncan test on the SGR value, feeding in the P1 treatment is significantly different from the P2 treatment, feeding in the P2 treatment is not significantly different from the P3 treatment, and feeding in the P3 treatment is not significantly different from the P4 treatment.

The results of the observation of the growth rate of catfish during 30 days of maintenance showed that the different doses of kecipir seed extract in each treatment resulted in different average weight gain of catfish. The highest and best daily growth rate of catfish based on ANOVA and Duncan's test was found in treatment P4 (52.49 ± 9.18 ^{c} %/day) which means significantly different from treatment P1 (22.89 ± 1.68 ^{a} %/day), but not significantly different from treatment P3 (46.06 ± 5.03 ^{bc} %/day). Based on the results of the study, the addition of kecipir seed extract is significantly different from the growth rate of catfish. This is thought to be due to the presence of active ingredients in the kecipir, namely saponins, flavonoids, polyphenols, steroids, tannins, triterpenoids, and terpenoids. According to the discussion shown in the absolute length growth.

Based on the results of the study, the provision of kecipir seed extract is significantly different from the FCR of catfish so that it can be said that the amount of feed consumption is converted into the weight of catfish which indicates the growth rate of catfish. According to Syarif *et al.* (2022), feeding in accordance with fish needs can increase fish growth. Nores and Suharman (2020) explained that the better the quality of a feed, the faster the growth rate of fish. Fish growth is influenced by several factors, namely internal factors and external factors. Internal factors are generally factors that are difficult to control, including heredity, sex, age, parasites, and disease. External factors include food and environment. Other factors that affect fish growth are factors that transform food into fish body tissues such as the amount of feed consumed, food digestibility, digestion rate, frequency of feeding, absorption of food substances, and feed efficiency and conversion (Dharma *et al.,* 1986 *in* Muchdar *et al.,* 2023). The type and quality of feed and environmental conditions also greatly affect the growth rate of fish. According to Ratnasari *et al.* (2020), the speed of fish growth rate is strongly influenced by the type and quality of feed given and environmental conditions. If the feed given is of good quality in sufficient quantity and the environmental conditions are favorable, it can be ascertained that the growth rate of fish will be faster as expected.

3.6. Survival Rate (SR)

Based on the analysis results in Figure 6, the highest SR was obtained in the P1 and P3 treatments with a value of 92.5 ± 0.50%, followed by the P4 treatment with a value of 90 ± 1.15% and the lowest treatment was found in the P2 treatment which was 87.5 ± 0.96%. Furthermore, the results of the analysis of catfish SR were tested *One Way* ANOVA analysis.

Based on the results of the *One way* ANOVA test on the SR value of catfish, the value of Fhitung <Ftabel 5% (0.33 <3.49) with a confidence interval of 95% and an error rate of α = 0.05, because Fhitung (P) is smaller than Ftabel (0.05) thus rejecting H1 or accepting H0. This means that the addition of kecipir seed extract to the feed has no significant effect on catfish survival. The results of the ANOVA test analysis of catfish SR have no effect, so there is no need to do further DMRT (*Duncan Multiple Range Test*).

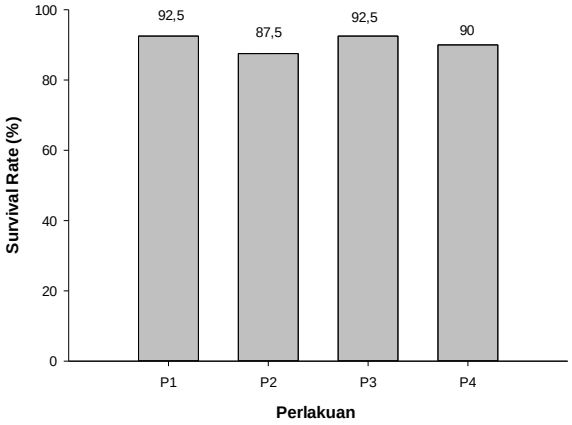


Figure 6. SR Analysis Results (%) of Catfish

Based on the results of research during 30 days of catfish maintenance is classified as good. The provision of kecipir seed extract in the feed is not significantly different from the survival of catfish. This indicates that the use of the extract with the dose does not exceed the dose for 50% mortality, so the material is safe for fish. A good survival rate of catfish ranges from 73.5-86%. Fish survival is determined by several factors, including the ratio between the amount of feed, density, and water quality including temperature, ammonia levels, dissolved oxygen, and acidity (Yuniarti, 2006 *in* Sarumaha *et al.,* 2021). According to Mulyani *et al.* (2014) stated, that the survival rate (SR) ≥50% is classified as good, 30-50% survival is moderate and less than 30% is not good.

According to the opinion of Adegboyega *et al.,* (2019), the kecipir seeds are thought to contain flavonoids and have antioxidant activity. Secondary metabolite compounds of the flavonoid group perform antioxidant activity by suppressing the formation of reactive oxygen species against other organisms (Harborne, 1987 *in* Oktavianus, 2013). In accordance with Handayani's (2017) statement, flavonoids are secondary metabolite compounds, these compounds provide biological effects for growth, fish endurance, anti-stress in fish, anti-pathogens in fish such as fungi, bacteria, viruses.

The addition of kecipir seed extract to the feed no effect on the survival of catfish reared during the study. The death of some fish that occurred during maintenance was likely due to the struggle for food so that some catfish could not get food intake and died. According to Yuniarso (2006) *in* Ratnasari *et al.,* (2020) stated that the factors that influence the high percentage of survival are biotic and abiotic factors such as *competitors*, population density, disease, age, and the ability of organisms to adapt.

3.7. Water Quality

The results of measuring the average water quality of each treatment during catfish rearing can be seen in Table 2.

Table 2.
Average Measurement Results of Water Quality

Parameters	Optimal Range	Treatment			
		P1	P2	P3	P4
Temperature (oC)	20-30oC	27	27,3	27,2	27,1
pH	6,5-8,5**	7,5	7,39	7,44	7,43
DO (mh/L)	>3 ml/l***	3,43	3,37	3,41	2,5

Notes: *Khairuman *et al.,* 2012; **Ghufran *et al.,* 2010; ***Surya, 2018.

Based on the measurement of water quality parameters in catfish rearing containers, the average temperature results are obtained in the P1 treatment 27^{o}C, P2 treatment with an average of 27.3^{o}C, P3 treatment with an average of 27.2^{o}C, and P4 treatment with an average of 27.1^{o}C. The temperature value

obtained during the study was classified as good in accordance with the standard. A good temperature value in water for fish growth ranges from 20-30 ° C, with a good optimal temperature for fish growth at 27 ° C (Khairuman *et al.,* 2012).

The pH value during the study was stable in the neutral range, namely treatment P1 getting an average of 7.5, treatment P2 with an average of 7.39, treatment P3 with an average of 7.44, and treatment P4 with an average of 7.43. The pH value obtained during the study was considered good for catfish growth. Good water acidity (pH) for catfish is around 6.5-8.5. The pH level of 9 and above can cause the appetite for catfish to decrease and if the pH level of the water is below 5, it can cause clumping of mucus in the catfish gills (Ghufran *et al.,* 2010).

The results of DO measurements during maintenance obtained treatment P1 with an average DO of 3.43 mg/L, treatment P2 with an average DO of 3.37 mg/L, treatment P3 with an average of 3.41 mg/L, and treatment P4 with an average of 3.5 mg/L. The measurement of water DO during the study was classified as good because it was not less than 3 mg/L. According to Surya (2018), the DO content requirement for catfish enlargement cultivation is at least 3 mg/L.

4. Conclusion

Based on the results of the research that has been done, the conclusion that can be obtained is the effect of the addition of kecipir seed extract is able to increase the growth of absolute length, absolute weight, FCR, and SGR of catfish then the optimal dose of kecipir seed extract in feed based on increased growth, which includes absolute length, absolute weight, FCR, and SGR obtained from the P4 treatment, which is 5% or equal to 50 ml / kg of feed.

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