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EFFECT OF ADDITIONAL CHROMIUM-YEAST ON GROWTH PERFORMANCE OF GURAME FISH SEED (*OSPHRONEMUS GOURAMY*)

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ABSTRACT

This study aims to determine the effect of adding chromium-yeast with an optimal dose so as to produce the highest growth of carp seeds. This research was conducted in March 2020 to May 2020. The method used in this study was a completely randomized design (CRD) with 4 treatments and 4 replications. The treatments were A (control), B (1.5ppm chromium-yeast / kg feed), C (3.2ppm chromium-yeast / kg of feed), D (4.2ppm chromium-yeast / kg of feed). The results obtained from this study were the addition of chromium-yeast was able to increase the Daily Growth Rate (DGR) and Feed Efficiency (FE) of carp. The highest growth value in this study was found in treatment C (with the addition of chromium-yeast 3,2 ppm) with DGR of 3.06%, total survival of 100% and EP of 68%.

The first page should be used only for Title/ Keyword/ Abstract section. The main paper will start from second page.

1. INTRODUCTION

Carp (Osphronemus gouramy) is one of the leading fish in aquaculture because it has a higher selling value compared to other freshwater fish [1]. The price of carp, which is relatively more expensive than other fish and easy to cultivate, has made many fish farmers choose carp as the main organism for cultivation. The Ministry of Marine Affairs and Fisheries statistical data shows that carp production in 2018 reached 356,053 tons, an increase of 187,053 tons from 2017, which was 169,000 tons [2].Production factors that support gouramy cultivation include parent, seed, and feed. Slow growth and low survival are still obstacles in the effort to provide carp seeds. Low seed quality causes inefficient use of the feed given. The most important problem in the maintenance of carp is the provision of feed for the seeds. Good quality feed is feed that meets all of the fish seed feed needs [3].

A good feed for fish contains higher protein, because protein is the main energy source for fish. Protein is an expensive source of feed energy, especially protein derived from fish meal. Protein is the most important substance of all nutrients needed by fish because it is a constituent substance and the main source of energy for fish [4]. In fish, protein is more effectively used as an energy source than carbohydrates [5]. This is due to the low ability to regulate plasma glucose concentrations, which is thought to be caused by deficiency of the hormone insulin [6]. In general, fish are less able to utilize carbohydrates in feed. The ability to utilize carbohydrates in the diet of each fish species varies. Omnivorous and herbivorous fish are able to utilize carbohydrates by 30-40%, while carnivorous fish are only able to utilize carbohydrates by 10-20%.

The difference in the ability to use carbohydrates for each fish species is different. This is due to the ability of the fish digestive organs to digest feed carbohydrates and the availability of insulin in transferring glucose into cells as a source of energy [7]. Several studies have shown that the presence of chromium-yeast in feed can increase the efficiency of carbohydrate utilization. Chromium, as a micronutrient, has a major role in the interaction between insulin and receptor cells that are present together as a complex compound called Glucosa Tolerance Factor (GTF). GTF boosts insulin activity, bringing lots of glucose into the cells. The cells will convert glucose into energy. This additional energy is a source of energy for protein synthesis, tissue growth, cell maintenance and increased fertility. Chromium, like other essential microminerals, has a certain dose in order to function optimally [8].

Therefor it is necessary to make various efforts to increase the activity of GTF (Glucose Tolerant Factor) so that the use of protein as an energy source can be reduced and the use of carbohydrates as an energy source can be increased. Protein is expected to be used for growth and replacement of damaged tissue, not as an energy source. Increasing the use of carbohydrates by fish is expected to increase carbohydrate content and reduce protein content in the composition of artificial feed, thereby reducing feed prices. One alternative that can be developed to overcome the above problems is by giving chromium-yeast supplements to feed as a micronutrient which plays a role in stimulating insulin activity to carry glucose into cells and then convert glucose into energy. Therefore, the initiation of mixing artificial gouramy seed feed with chromium-yeast was carried out to accelerate the growth rate by increasing the efficiency of carbohydrate utilization.

2. Research Method

This research was conducted in the Gurame Fish Cultivation Group in Kertayasa Pangandaran Regency. This research was conducted for 42 days, from March to May 2020. The tools used in this study consisted of 16 1m nets, DO meters, pH meters, ammonia test kits, and digital scales. The ingredients used are 400 carp fry, commercial feed with a protein content of 31-33% protein, progol and chromium-yeast.

The research method used in this research is an experimental method designed using a completely randomized design (CRD) consisting of 4 kinds of treatments with 4 replications. Each treatment container was filled with 25 carp seeds. The treatments were carried out as follows:

Treatment A = 0.0 ppm (control)

Treatment B = 1.5 ppm chromium-yeast / kg of feed

Treatment C = 3.2 ppm chromium-yeast / kg of feed

Treatment D = 4.2 ppm chromium-yeast / kg of feed

2.1 Fish Maintenance

The tested fish used were carp seeds from the Gurame Fish Cultivation Group in Kertayasa, Pangandaran Regency. Gouramy seed biomass was weighed on the first day to determine the average initial weight. Feeding was given 3 times a day, at 08.00, 12.00, and 18.00 WIB using a test mixture of 5% fish biomass, progol and chromium-yeast with different amounts in each treatment according to the research method. Gouramy seeds are maintained for 42 days. Calculation of weighing biomass, viability and the amount of feed consumed is done once for 7 days. Water quality measurements were carried out on the first day of the study and once every 7 days for up to 42 days.

Figure 1. Gouramy seeds

2.2 Test Feed

The test feed used in this study is commercial feed that is suitable for treatment and then supplemented with chromium-yeast. The process of making feed containing chromium-yeast begins by dissolving progol as an adhesive, then adding chromium-yeast according to the research treatment, then mixing it into the feed and stirring until it is homogeneous, so that the chromium-yeast bonded to the feed is formulated, after that, it is dried by aired and finally the feed is ready to use. The feed that has been mixed with chromium-yeast must be completely dry because if it is wet it will rot easily. Chromium-yeast mixing in feed is done every 7 days.

2.3 Observation Parameters

2.3.1 Daily Growth Rate

The daily growth rate or *Average Daily Growth* (ADG) of fish is calculated using the Effendie formula (1997) as follows.

$$ADG = \frac{-Wo}{t} \text{ x } 100\%$$

Information:

ADG = Daily growth rate
Wt = Average daily weight of fish at the end of observation (g)
Wo = Average daily weight of fish at the beginning of observation (g)
t = Length of observation (days)

2.3.2 Survival

The survival rate can be calculated according to the formula [9]

$$SR = \frac{Nt}{No} \text{ x } 100\%$$

Description:

SR = survival rate
Nt = number of fish
No = number of fish

2.3.3 Feed Efficiency

Calculation of feed efficiency with the formula [10] As follows:

$$EP = \frac{(Wt - Wd) - Wo}{F} x\,100\%$$

Description:

EP = Feed Efficiency (%)
Wt = Weight of the test fish at the end of the study (gr)
Wd = Total weight of dead fish (g)
Wo = Weight of test fish at the beginning of the study (gr)
F = Total amount of feed consumed (gr)

2.3.4 Chromium on Fish Meat

The chromium test on fish meat was carried out using the Atomic Absorption Spectrophotometer (AAS) method which is based on SNI 2354.5: 2011. The chromium content in fish meat can be calculated using the following formula.

$$K = \frac{Cr\ x\ V\ x\ FP\ x\ 10^{-2}}{W\ x\ 10^{-2}}$$

Where:

K = concentration of Cr in fish meat (mg / kg)
Cr = reading of Cr on AAS (mg / L)
V = volume of Erlenmeyer flask (mL)
FP = multiplier factor (1)
W = sample weight (grams)

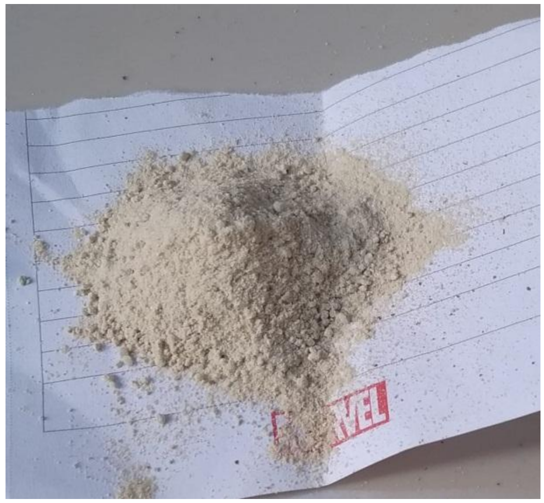

Figure 2. Chromium-yeast

2.3.5 Water Quality

Measurement of water quality parameters is carried out to determine the condition of maintenance water in each container. The water quality parameters measured included temperature, pH, ammonia and DO which were carried out at the beginning and every 7 days during the research.

2.4 Data Analysis

The effect of each treatment on the parameters was analyzed using Analysis of Variance (ANOVA) with a confidence level of 95%. If the results between treatments there are significant differences, then Duncan's continued test will be carried out with a confidence level of 5%.

3. Results and Discussion

3.2 Daily Growth Rate

Growth rate is a change in shape as a result of increasing length, weight, and volume in a certain period [9]. Based on the observations of gouramy seeds for 42 days, it can be seen that the addition of chromium-yeast treatment with different percentages in the feed gave different weight increases. The addition of chromium-yeast to gouramy seed feed gave a good response to fish growth, this could be seen from the increase in the average weight of individual gouramy seeds in each treatment with increasing maintenance time (Figure 1).

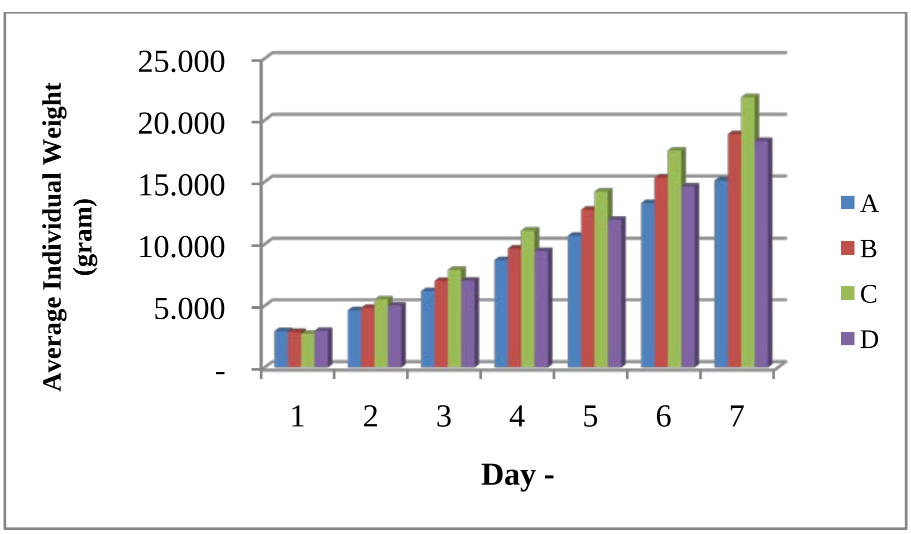

Figure 3. Curve of Gouramy Seed Weight Gain

The observations from day 0 to day 42 show that the feed is mixed with chromium-yeast with doses of A (control), B (1.5ppm), C (3.2ppm) and D (4,2ppm). The growth pattern of each treatment shows a logarithmic phase, where in this phase the growth goes fast and the weight of the carp seeds increases every day [11]. The results of the percentage of daily growth rate can be seen in Figure 2.

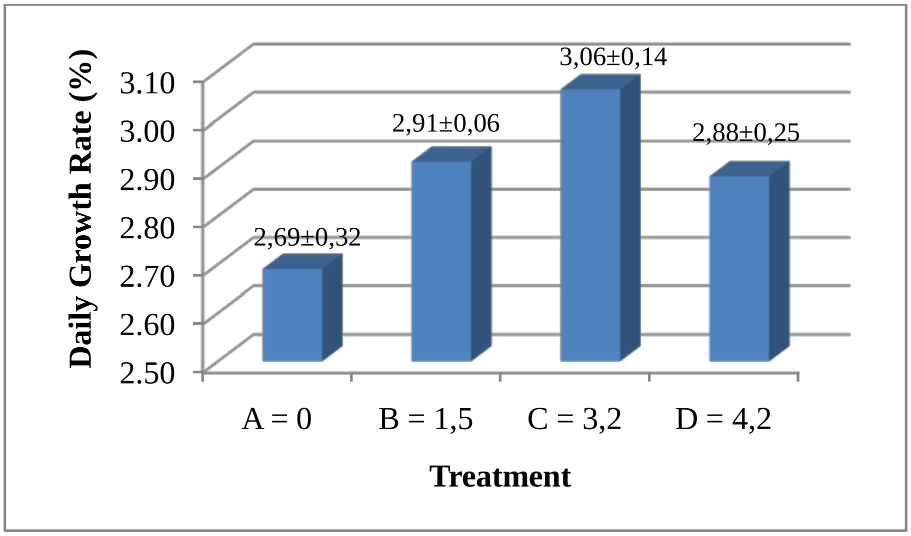

Figure 4. Bar Chart of Daily Growth Rate of Gurame Fish Seeds during the Study

Based on observations for 42 days, the daily growth rate of gouramy seeds treated with chromium-yeast has different results. The highest observed value was in treatment C with a magnitude of 3.06%, while the smallest was in treatment A of 2.69% where treatment A was treatment without giving chromium-yeast.

Based on the results of the analysis of the variance of giving chromium-yeast on gouramy seeds with the addition of chromium-yeast A (control), B (1.5ppm), C (3.2ppm) and D (4.2ppm) had a significant effect on the daily growth rate of seeds. gurame fish. Treatment A was significantly different from all treatments. Treatment B and D were not significantly different while treatment C was significantly different from treatments A, B and D. And the highest daily growth rate was in treatment C with a value of 3.06 ± 0.14. This indicates that gouramy seeds with the addition of chromium-yeast in the feed will make their growth more optimal. According to Yanto [12] the highest daily growth rate is closely related to optimal chromium levels in the feed, so that it can improve insulin performance through the glucose tolerance factor (GTF) to maximize blood glucose into target cells as a source of metabolic energy, protein. (amino acids) can also be used for the synthesis of body proteins. On the other hand, chromium as an active component in GTF or chromodulin has a fairly wide range of effects, including a reduction in protein requirements, resulting in savings in protein use and an increase in growth rate [13]. Chromium has important potential, especially in carbohydrate metabolism. In addition, chromium has potential in the metabolism of lipids, proteins and nucleic acids. Therefore, chromium is able to increase the efficiency of carbohydrate and lipid utilization as an energy source, as well as protein for growth in order to increase the efficiency of feed utilization [14].

3.1 Survival Rate

Survival is an indicator to see the extent to which living things can survive. Another definition is a ratio between the number of organisms living at the end of the study with the number of organisms at the time of distribution expressed in percentage terms. The greater the percentage value indicates the more organisms that live during maintenance [9]. Survival can be used as a measure to determine tolerance and the ability of cultivated organisms to live. The survival value of gouramy seeds during the study can be seen in Figure 5.

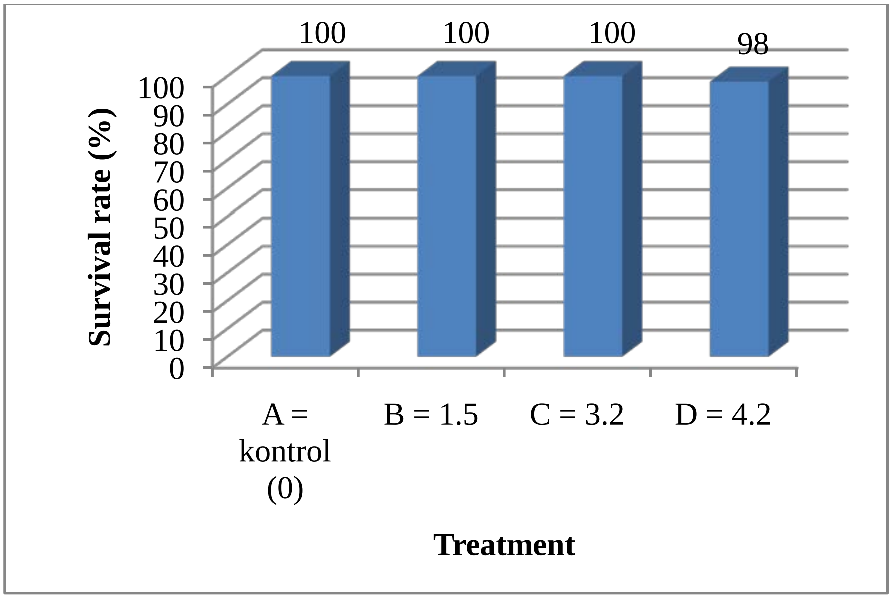

Figure 5. Seed Survival during the Study

Based on observations, the carp for 42 days shows that the survival value of treatment A (control) is 100 %, treatment B with the addition of chromium-yeast 1.5 ppm / kg of feed at 100%, treatment C with the addition of chromium-yeast 3.2 ppm / kg of feed by 100%, while treatment D with the addition of chromium-yeast 4.2 as large as 98%. The resulting survival value showed that in treatment D, there were dead fish. This is because the gouramy seeds under study are still in adjustment at the initial stage of the research, at the beginning of the research, the dead fish could be caused by stress on the fish in facing its new environment. This condition is in accordance with the statement of [15] which states that stress is an adaptation of physiological changes resulting from various environmental stressor factors.

Another factor that can affect is feed, the need for fish to energy obtained from consuming feed is one of the important things related to fish survival. As Irianto [16] argues that feed is an important factor for fish survival, Irianto stated that feeding with adequate and balanced nutrient content will affect the health and survival of fish.

The results of the observation of the survival percentage of gouramy fry that the fish with the control treatment (0%) and which were given feed with the addition of chromium-yeast 1.5 ppm and 3.2 ppm produced the highest survival compared to fish given the addition of 4.2 ppm organic chromium. This shows that the addition of chromium-yeast must be at the optimum level in order to work well for the survival of the fish. Chromium at an optimum concentration can increase the entry of glucose in the blood, so that carbohydrates can act as a protein *sparing effect* in tissue formation so that fish can grow better.

3.3 Feed Efficiency

Feed efficiency is a description of the provision of feed that is given so as to increase growth. The value of feed efficiency shows the ability of fish to use feed well. The value of feed efficiency is obtained from the ratio between growth and the amount of feed consumed by fish [17]. the greater the value of feed efficiency, the more efficient the utilization of feed in the fish body and the better the feed quality. The yield of gouramy seed rearing for 42 days with the addition of chromium-yeast resulted in varying feed efficiency values (Figure 4).

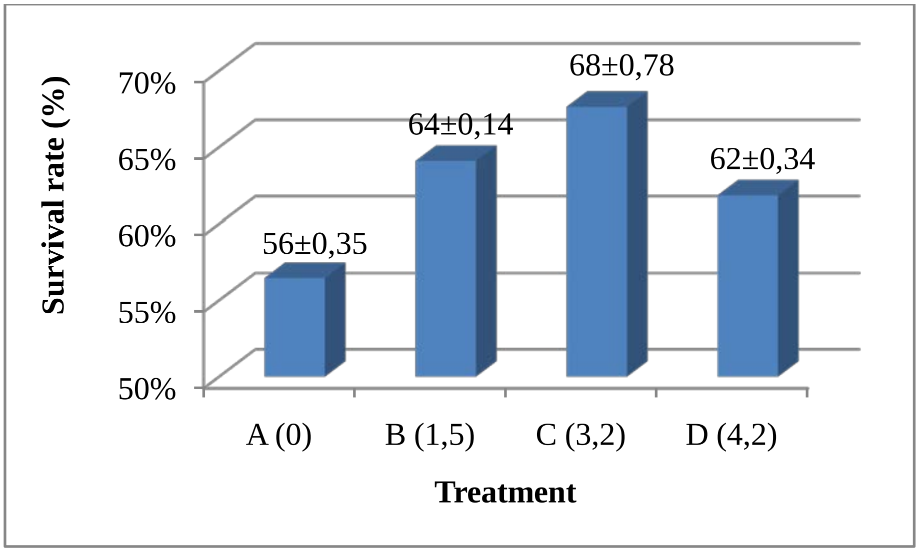

Figure 6: Feed Efficiency Bar Chart for Gurame Fish Seeds During the Study

Based on Figure 3, it can be seen that the highest feed efficiency value was obtained in treatment C with a value of 68%, followed by treatment B, namely 64%, treatment D, namely 62% and the value of feed efficiency. The smallest was obtained in treatment A, namely 56%. These results indicate that the value of feed efficiency consumed by carp seeds is very good, as well as the statement of which states that the optimal feed efficiency value for carp is more than 50%.

The difference in feed efficiency values can be concluded that the addition of chromium-yeast at a dose of 3.2 ppm has the best feed efficiency value and is far different from the control treatment which is 12%. The addition of chromium-yeast with the right dose in feed is very useful as an energy source to meet the needs of fish in accelerating fish growth. Likewise, the statement by [14] states that the addition of organic chromium is expected to stimulate insulin action, so that glucose can enter cells through the bloodstream. Furthermore, the carbohydrate cell will undergo a glycolysis process. By entering glucose as an energy source into the citric acid cycle, it will increase the number of acetyl CoA molecules, so that the energy produced also increases. The increase in the amount of energy produced causes the energy allocation for growth to also increase and growth will increase. The high value of feed efficiency is the same as the value of the daily growth rate of carp seeds. This means that the daily growth rate is directly proportional to the value of feed efficiency. Similar to Huet's statement in Sugianto [11] that high growth rates are associated with high feed efficiency as well.

3.4 Chromium in Fish Meat

Chromium is a heavy metal that has a valence number of +2 to +6. 3-valent chromium (trivalent) is the most stable form and has physiological functions, however, chromium with valence 3 is very difficult to be absorbed from the digestive tract [13]. The results of chromium testing on gouramy seed meat can be seen in (Table 1).

Table 1.Chromium content in gouramy seed meat

Treatment	Concentration in chromium-yeast (ppm)	Chromium fish meat (mg / kg)
A	0	-
B	1.5	0.1233
C	3.2	0.1587
D	4.2	0, 1634

Based on the analysis results showed that the combination of treatments given and the addition of chromium for each treatment was different. According to [18], the addition of chromium to feed can affect chromium levels in fish bodies. The higher the chromium content in the feed, the higher the chromium content value in the fish's body. The highest chromium content value in treatment D with the addition of chromium-yeast 4,2ppm had a chromium content value in meat of 0.1634 ml / kg. The lowest value obtained in treatment B with the addition of chromium-yeast 1.5 ppm has a value of 0.1233 and treatment C (3.2ppm) the value of chromium content in meat is 0.1587. Meanwhile, in treatment A, the chromium content was not tested because the test feed was not given the addition of chromium-yeast.

The limit of metal contamination according to Dirjen POM No. 03725 / B / SK / 89 concerning the limit of metal contamination in food, which is 2.5 mg / kg. If referring to the limit of metal contamination according to the BPOM, the carp in this study are below the threshold and safe for consumption. The chromium content in carp in this study is organic chromium with three valence (Cr^{3+}) so that it is safe for fish to use and for human consumption. This also makes organic chromium widely used for both animals and humans.

Regarding the utilization of Crchromium,$^{3+}$ according to Linder's (1992) statement, trivalent chromium (Cr^{3+}) is known as an essential mineral component of GTF, namely a water-soluble liver component, blood plasma,('*brewer's yeastbrewer's yeast').*) and some biological and cell extracts. So in connection with this, it can be seen that trivalent comium (Cr^{3+}) is a metal from the micromineral group which has been recognized as essential for both humans, ruminants and non-ruminants including fish.

In this study, both the feed with the addition of chromium and the yield of carp from this study can be used both. Carp is still within the limits tolerated by the human body according to BPOM standards. This chromium-yeast can then be used as a supplement in feed, because it has a good effect on fish growth and in optimal amounts it can be consumed by humans.

3.5 Water Quality

Water quality is measured to determine the suitability of the waters used as a medium for raising fish. Good water sources in aquaculture activities should meet the water quality standard criteria so that fish can grow and develop well should. Water quality is one of the important things in fish farming because it can affect the growth of these fish [19]. The results of water quality measurements during this study were temperature, dissolved oxygen (DO), degree of acidity (pH) and ammonia. in the pond gouramy seed rearing is still within the feasibility range according to the specified standards (Table 2).

Table 2. Water Quality Maintenance Media During the Study

Weekto	Water Quality			
	temperature (0C)	DO (ppm)	pH	Ammonia (ppm)
1	27.2	4	7	0
2	27.1	3.6	6.5	<0.01
3	27	3 , 5	7	<0.01
4	28	3,4	7	<0,02
5	27	3,5	7	<0,02
6	26	5	7	<0,02
7	27	4	7	<0,02
SNI (2000)	25 - 30		6.5 - 8.5	
Sarwono (2000)		> 3		
Sendjaja (2002)				<1 The

Temperature obtained during the study is still in the tolerable range of gouramy so that it does not interfere with the metabolic processes that have an impact on the growth and survival rate of gouramy. Temperature can affect the activity of eating fish, an increase in temperature can affect the metabolic activity of fish, the higher the temperature, the faster the waters will become saturated with oxygen.The temperature during the study ranged from 26 ° - 28 ° C. According to [20] a good temperature range is 25 ° -30 ° C.

Dissolved oxygen (DO) is the amount of oxygen gas dissolved in water. The solubility of oxygen in water is influenced by several factors including salinity temperature and water movement [21]. The content of dissolved oxygen (DO) helps in the process of oxidizing waste materials and burning food to produce energy for the life and growth of gouramy. Dissolved oxygen decreases with the amount of metabolic waste. In Dissolved Oxygen (DO) research, maintenance ranged from 3.5 mg / l - 5 mg / l. However, the dissolved oxygen content obtained during maintenance is still in the optimal range for life and growth of gouramy. According to Susanto

(2000), the minimum oxygen required by carp must be more than 3.0 mg / l.

The pH value can indicate the quality of a waters as a living environment for fish, which is one of the parameters that plays a role in determining primary productivity, although the quality of the waters depends on other factors. The low degree of acidity (pH) will cause the acidity to increase, if that happens then the condition of the waters will cause a decrease in water quality so that it can lead to decreased appetite for fish [22]. The acidity level (pH) during the study ranged from 6.5 mg / lt - 7 mg / lt and the pH value was still in the range tolerated by gouramy [20].

Ammonia content during maintenance was 0.00 - 0.02 mg / l (Table 4). The increase in ammonia during maintenance is due to the increase in metabolic waste materials along with the increase in growth. The waste material tends to be acidic so that it affects the increasing ammonia content. The ammonia obtained is still well tolerated by gouramy, so that its growth and survival are still good. This is consistent with the statement of [23] that the ammonia level that can be tolerated by gouramy is 0.0 - 0.12 mg/l.

4. Conclusion

The conclusion obtained from the research that has been carried out is that the most optimal growth with the addition of chromium-yeast in gouramy seed feed, the most optimal treatment for the growth of gouramy seeds is treatment C with a daily growth rate of 3, 06 ± 0.14, for the best treatment feed efficiency in treatment C with a value of 68 ± 0.78, survival showed the best in treatments A, B and C at 100%. Referring to the discussion and conclusions that have been presented, it is recommended that feed with as much chromium-yeast as 3.2 ppm incorporated in feed supplement as gouramy seeds gives the best growth results.

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