The effect of giving cake artificial feed on the survival rate, and growth of Common carp (*Cyprinus carpio*) larva in an Installation of Freshwater Culture (IBAT) in Punten, Batu.

I P Zainiyah¹, Rozi², W H Satyantini³, A M Sahidu⁴

¹Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya 60115, Indonesia
²Department of Fish Health Management and Aquaculture, Faculty Fisheries and Marine, Universitas Airlangga, Surabaya 60115, Indonesia
³Department of Marine, Faculty Fisheries and Marine, Universitas Airlangga, Surabaya 60115, Indonesia

*Corresponding Author: rozi@fpk.unair.ac.id

Abstract. Feed is involved in supporting the success of cultivation activities. Thus, an intensive system study is needed to find the right formulation so then these objectives can be achieved optimally. This research was conducted to test the optimal percentage of Cake artificial feed on the survival rate and growth of Common carp (*Cyprinus carpio*) larva and its relationship to reducing the cost of feeding to a minimum. The Cake artificial feed was given twice a day; morning and afternoon. The results of the Cake artificial feeding on the larval Common carp showed there to be no significantly difference in comparison with the administration of natural feed (*Artemia* sp.). The effect produced by the Cake artificial feeding on the growth of the larval carp was that SGR was 0.22±0.005 gr/day, FCR was 1.7±0,00 and the survival rate (SR) was 45±0,00 percent. The water quality parameters were measured during the research, including dissolved oxygen (DO) at 5.01 to 6.38 mg/L, pH ranging from 6.7 - 7.5 and an average water temperature of 24.5°C. In conclusion, Cake is not recommended to be given to the larval Common carp as an alternative to natural feed.

1. Introduction
Carp (*Cyprinus carpio*) are one of the fisheries’ sectors commodities in freshwater, and it is currently the prima-donna in the fisheries sub-sector. This fish has high economic value and there are a large number of requests for it, especially in several local markets in Indonesia. Carp, known as the common carp, is a fish that has a worldwide demand. This matter presents an opportunity for the development of better goldfish cultivation [1]. The increased production of Common carp driven by increasing knowledge about the growth and reproduction of the fish, according to data compiled by the Ministry of Maritime Affairs and Fisheries (MMAF), has meant that the production and development of carp have showed a good level of performance with an increase in the average production in 2010 - 2013 amounting to 7.09%. Judging from the performance achievement against the annual targets, it shows that the achievement in relation to the production of Common carp has been able to go meet the annual targets set with an average achievement of 104.3%, except in 2013 where production was not able to reach the target (68.17% of target). The numerical value of production only reached 90, 89% of the target as well. Several things can cause these targets to go unachieved; among others, due to the general capacity of the business carried out by the farmers still being on a small scale. On the other
Various farming systems have been implemented and continue to develop in order to obtain maximum goldfish production. One of them is applying intensive cultivation systems which are characterized by high stocking densities and the use of artificial feed, as well as modern technology. Fish farming intensively also has a negative impact, one of which is that the fish are susceptible to disease. Disease is one of the factors that can cause disruption in fish farming, and it can even cause death up to 100%. This is very detrimental, especially economically. One dangerous disease that can infect carp (Cyprinus carpio) is caused by a bacterial infection of Aeromonas hydrophila [2]. The factor virulence rate of A. hydrophila, which can cause fish mortality, depends on the toxicity produced such as aerolysin and hemolysin [3,4]. Current issues of aquaculture include the price of feed, as it is very expensive. The fed fish become very expensive due to their high protein content. The factor of feed can reach 80% of the total cost in cultivation activities, so then the feed become the main limiting factor for activities related to intensive fish cultivation. Therefore, efforts need to be made to improve the efficiency of the feed in order to reduce production costs.

Several factors must be considered in the provision of feed, including the quantity and quality of the feed, how easy it is to provide it, as well as the length of time that the seeds take to feed [5]. There are two types of feed for the fish fry; natural feed and artificial feed. The use of natural feed often results in losses as natural feed is seasonal, so at any given moment, it can become hard to come by. Based on some of the drawbacks of using the natural feed, the Installation Freshwater Culture (IBAT) Punten made an artificial feed innovation, namely using Cake artificial feed as a substitute for natural feed at the common carp hatchery.

2. Materials and methods
2.1 Common carp larvae

The fish that will be used are the common carp larvae, 4 days old with an average weight of approximately 0.009 grams with a total length of 8 mm. The amount of seed used for the treatment was as many as 100 larvae carp seed placed in the tank pond measuring 15 x 15 x 20 cm. The common carp larvae were obtained through the broodstock spawning. The broodstocks used had the following characteristics; for carp male broodstock, their body appeared smaller, they had more agile movements and if the stomach was striped, then there was white discharge from the genital orifice. The female broodstock had a visible bulging abdomen, slow movements and were not aggressive, their pit urogenitalia reddish color and it was somewhat open or widened [6].

Common carp eggs usually hatch two days after the broodstock spawning. Hatching the eggs usually occurs gradually. There is a hatching before 48 hours and after no more than 48 hours [7]. The time of hatching the eggs themselves is adjusted to the temperature of the location of the hatchery. For example, at a temperature between 23 °C to 26 °C, fish eggs will hatch approximately after 2 to 3 days [8]. Larva starts to develop after hatching, beginning from 2 - 3 days after the stocking of male and female broodstock.

2.2 Cake Artificial Feed

The feed used in the treatments was an artificial feed called Cake, pellets (granules) made of material like eggs as much as 1 kg, 2 sachets of Madurasa, scot emulsion as much as 2 tablespoons, flour 75 g, water as a solvent amount of 250 ml and skimmed milk as much as 250 grams. The materials used were easily available and not influenced by the existence of the season. The artificial feed cake was made manually with the help of support tools such as mixers, steamers, a stove etc. Once the cake batter became fodder, it was ready to be fed to the larval carp. The larvae were fed natural food, were then fed the cake instead of Artemia sp. or silkworms fed at a dose of 20% of their body weight. The larvae feeding was done twice a day; morning (08.00 am) and afternoon (16:00 pm).
2.3 Pond

The pond that was used during the research process consisted of three ponds, called a pool, because of the different processes. The first process was the broodstock spawning carp using a concrete pool with a size of 11 x 7.5 m. Before the pool was used to do the first process, we dried it with the aim of vaporizing the toxic gases of decomposition that may have been in the pool as sulfides (H₂S), nitrite (NO₂⁻) and ammonia (NH₃), and in order to eradicate pests that cause disease in fish.

The pond that was the location of the egg hatching was also made of concrete measuring 1.5 x 1.5 m. When the larvae were fed with the homemade cake, we used an aquarium pond measuring 15 cm x 15 cm x 20 cm. The cleaning of the aquarium was done 2 times a week. The measurement of the water quality included temperature, pH and DO every day in the morning (08.00 am) and afternoon (16:00 pm).

2.4 Research methods

The method used in this research was experimental method in order to determine the effect of artificial food cake on the growth rate, survival rate (SR), specific growth rate (SGR) and food conversation ratio (FCR) in larval carp.

2.5 Method of collecting the data

2.5.1 Specific Growth Rate (SGR)

According to the previous study [9], the specific growth rate (SGR) was calculated using the following formula:

\[
SGR = \frac{LnWt - LnWo}{t} \times 100\%
\]

Description:
- SGR : Specific daily growth rate (%/day)
- Wo : The average weight of the fish at the beginning of the study (gr)
- Wt : The average weight of the fish at the end of the study (gr)
- t : Time (long maintenance)

2.5.2 Feed Conversation Ratio (FCR)

According to the previous study [10], the ratio of feed consumption was calculated using the following formula:

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

Description:
- FCR : Feed Conversion Rate
- Wo : The weight of carp testing at baseline (gr)
- Wt : The weight of the test carp at the end of the study (gr)
- D : The number of test fish dead weight (gr)
- F : The amount of feed given (gr)
2.5.3 Survival Rate
According to the previous study [11], the survival rate (SR) was calculated using the following formula:

\[ SR = \frac{N_t}{N_0} \times 100\% \]

**Description:**
- **SR**: Survival rate / survival (%)
- **N0**: Number of fish at baseline (fish)
- **Nt**: Number of fish at the end of the study (fish)

3. Results and discussion

Based on the result of growth in the absolute weight of the carp larvae from feeding them pellets (P0), cake artificial feed (P1) and *Artemia* sp. (P2), the results were 0.57 g; 0.76 g; and 0.94 g respectively. These results indicate that P2 had the maximum amount of growth of 0.94 g. In addition to absolute loss results, it also showed that the growth of fish can be seen from the long absolute length growth of larval carp in P0, P1, P2, of 8.98, 9.42 and 9.88 cm respectively. The statistical test on the absolute weight values showed no significant difference in weight and length growth (P <0.05). The results of Duncan’s test showed that in relation to the value of the absolute weight in P2, there was no significant difference with treatments P0 and P1. For the absolute length, the value in P2 showed as not being significantly different from P0 and P1.

**Table 1.** Growth in the absolute weight average and median absolute length of larval carp (*Cyprinus carpio*) in relation to artificial feeding cake in IBAT Punten, Batu

| Parameter        | P0                | P1                | P2                |
|------------------|-------------------|-------------------|-------------------|
| Absolute Length  | 8.98 ± 0.13a      | 9.42 ± 0.2b       | 9.88 ± 0.06c      |
| Absolute Weight  | 0.57 ± 0.02a      | 0.76 ± 0.01b      | 0.94 ± 0.02c      |

Description: P0 (Control), P1 (Feed cake), P2 (Feed *Artemia* sp). Different superscripts indicate there are significant differences (p <0.05).

The statistical analysis showed that there were no significant differences (P <0.05) in the daily growth rate of the larval carp. Based on the results, Duncan’s Multiple Range Test noted that there were no significant differences in treatments P0 and P2, while for the treatments P1 and P2, there was no difference in the specific growth rate in treatment P2 (Feed *Artemia* sp.), Namely, it was 0.22 %/day, while the lowest specific growth rate in treatment P0 (control) was 0.18 %/day.

The survival rate (SR) in fish farming determines the success of cultivation. The higher the SR of the cultured fish, the more that the effort was successful. Based on the results of the statistical tests, it showed that different types of feed are influential at providing a real difference to the survival of the hatched larvae carp.

The FCR value of the fish obtained from P0, P1, and P2 were 1.8, 1.7 and 1.3. The P2 treatment showed the best results with an FCR of 1.3. Treatments P0 and P1 showed results that were not significantly different from the F count < F table (0.05).
Table 2. The average values of SGR, FCR, and SR during the rearing of the larval carp with pellet feed, cake artificial feed, and Artemia sp. in IBAT Punten, Batu

| Parameter | P0            | P1            | P2            |
|-----------|---------------|---------------|---------------|
| FCR       | 1.8 ± 0.05<sup>c</sup> | 1.7 ± 0.00<sup>b</sup> | 1.3 ± 0.05<sup>a</sup> |
| SGR       | 0.18 ± 0.005<sup>a</sup> | 0.22 ± 0.00<sup>ab</sup> | 0.22 ± 0.005<sup>b</sup> |
| SR (%)    | 41.00 ± 1.41<sup>c</sup> | 45.00 ± 0.00<sup>b</sup> | 59.00 ± 1.41<sup>c</sup> |

Description: P0 (Control), P1 (Feed cake), P2 (Feed Artemia sp.). Different superscripts in the same column show that there are significant differences (p <0.05).

Bad water quality greatly affects the quality of the resulting seed production. Good water quality is what is acceptable to the fish and is that which does not negatively affect the growth of the fish, the hatching of their eggs and their survival. The water quality parameters during the larval rearing with the cake have been described in Table 3.

Table 3. Water quality parameter over 21 days in the rearing of carp larval fed with feeding pellets, cake artificial feed, and Artemia sp. in IBAT Puten, Batu

| Parameter | Result | References                                      |
|-----------|--------|------------------------------------------------|
| pH        | 6.9    | 6.5 to 8.5 (SNI 01-6483.4-2000) 27-            |
| Temperature | 22    | 30 °C (SNI 01-6483.4-2000)                   |
| DO (ppm)  | 5.4    | > 5 mg / L (SNI 01-6483.4-2000)              |

Growth highest Punten carp larvae were fed Artemia sp. because of the higher protein content than the feed pellets and cake. Fish at the level of the early stage that the age of 5 to 90 days generally requires a feed composition with a higher protein content compared to the advanced stage ie after the age of 90 days [10]. Protein in the fish body is needed for tissue repair, the growth of new tissue, energy metabolism, metabolism into substances vital body functions, enzymes that are essential for normal body function, and certain hormones [11].

This suggests that feeding Artemia sp. provides for the good growth of larval carp. The growth that occurs in fish is defined as a change in weight or length over a specific time and it is a complex biological process that is influenced by internal and external factors. The addition of the weight and body length of the fish is also associated with the ability of the fish to utilize the feed that it is given to digest. The characteristics of the feed cake are that it is easy to decompose in the water, so much the composition of feed not consumed by larval carp. According to the previous study [12], the lower the resistance of the feed in the water, the faster the feed is miscible with the water. The characteristics of the feed cake are that it is easy to decompose in the water so much the composition of feed not consumed by larval carp.

The factors affecting survival are biotic and abiotic factors. The biotic factors include the ability to swim and to catch food, their stress level, and age. Abiotic factors affect the availability of food and water quality. The carp larvae fed Artemia sp. showed that the food competition factor was higher than when the seed were fed pellets and cake. The texture of the cake soluble feed also affects the process
of the larvae eating the cake because the feed settles at the bottom of the tank and becomes fungus. The seed survival of the Punten carp was allegedly also affected by their swimming ability. The seed carp aged 14 days old were still limited in their swimming ability, as they were namely swim clustered at the edge and surface of the pond. Because of this, the fish being limited in their swimming ability led to their ability to find prey also being limited. The fish therefore tend ed to eat the feed that was nearby [13].

The values being lower than the feed conversion means that a good quality feed was given. Meanwhile, when the value is high for feed conversion, it means that the feed quality is poor. The value of the FCR of the feeding cake was 1.71, which means that the value does not comply with the FCR being good according to the existing literature. If you have a good FCR value, then it can be said that the use of the feed for growth is inefficient. The smaller the value of the FCR means, the more efficient the use of the feed is, and the more that the feed quality can be seen through the feed conversion. The value of the FCR provides an overview of the efficiency of the feed used for growth [14]. The high-value FCR in the control treatment and cake is due to the accumulation of organic material in the aquarium that was not consumed by the larval carp.

The measurement results of the aquarium water temperature during the larval rearing showed that the temperature is at a lower number when compared with the literature that is a mean of 24.5 °C. According to [15], the optimal temperature for the maintenance of post-larval carp ranged between 25 - 30 °C. Changes in the water temperature can drastically turn off the water biota due to changes in the carrying capacity of their blood; the higher the water temperature, the lower the solubility of oxygen in water and vice versa [16].

Based on the data from the results of the measurements of the water quality parameters, the mean of the dissolved oxygen (DO) for maintenance ranged from 5.01 to 6.38 mg / L, and this can be said to be still feasible for the maintenance of larval carp. This is in accordance with the previous study [17] stating that the dissolved oxygen levels are appropriate for carp larvae growth, and should not be less than 4 mg / L. The results of the pH measurement were 6.7 to 7.5. The mean pH can still be declared eligible for the maintenance of carp larvae. The degree of acidity (pH) was within the range for the larval growth of carp, ranging between 6 - 9. It is also in accordance with the optimum pH according to SNI 01-6133-1999, ranging from 6.5 to 8.5. All of the water quality parameters measured remained within the recommended limit for carp larvae life.

4. Conclusion

The maintenance of the larvae with homemade cake produced a fairly good growth in as evidenced by the SGR value of 0.22 ± 0.005 gram/day, for a value of 1.71 ± 0.00 FCR. This shows that the artificial food cake included in the feed is not efficient for the growth of carp. The survival rate (SR) of carp is 45 ± 0.00%, and there was a real difference to feeding with pellets (P0), with cake (P2) and using natural feed Artemia sp. (P2).

5. References

[1] Suseno D 2000 Management of Carp Hatchery Business. Penebar Swadaya Jakarta
[2] Dilek O R A and Hulya T 2007 Isolation and antibiotic susceptibility of Aeromonas hydrophila in a carp (Cyprinus carpio) hatchery farm. Bull Vet Inst Pulawy, 51, 361-364
[3] Rozi, Kusdarwati R, Nindarwi D D and Stella M S P 2018 Study on characterization pathogenicity and histopathology of disease caused by Aeromonas hydrophila in gourami (Osphronemus gouramy) IOP Conf Series. Earth and Environmental Science, 137
[4] Rozi, Kusdarwati R and D D Nindarwi 2018 Detection and analysis of hemolysin genes in Aeromonas hydrophila isolated from Gouramy (Osphronemus gouramy) by polymerase chain reaction (PCR) IOP Conf Series. Earth and Environmental Science, 137
[5] Priyambodo K and Wahyuningsih T 2002 Natural Feed for fish cultivation. Jakarta: Governmental spreader: 28-32
[6] Utomo N B P, Zairin M, Yusuf T L and Mokoginta Stars M 2005 Effect of Vitamin E With Different Level Reproductive Performance Against Zebra fish (Danio rerio). IAI, 4, 125-129
[7] Susanto H 2002 Enlargement Enterprise Hatchery and Common carp (Cyprinus carpio Linnaeus). Jakarta: Governmental spreader: 4-20
[8] Ferdianto S and Hendra T 2009 Raising of Common carp. Bandung: Arifano Kingdom
[9] Zonneveld N, Huisman E A and Boon J H. (1991). Principles of Aquaculture. Jakarta: Gramedia Pustaka Utama: 318
[10] Sahwan M F 2001 Fish feed and shrimp. Jakarta: Sower Self Reliance.
[11] Murtidjo B A 2001 Fish feed Concocting Guidelines. Doubleday. Yogyakarta: 196.
[12] Mulyana T Z 2004 Providing some feed efficiency for fish eel (Anguilla sp.) Maintained in Recirculation System. Essay. Department of Aquaculture. Faculty of Fisheries and Marine Science. Bogor Agricultural Institute. Bogor: 50.
[13] Melianawati R and Imanto P T 2004 Natural Selection. Larval Fish Feed Red Snapper, Lutjanus sebae. IFRJ, 10(1), 21-24.
[14] Steffens W 1989 Principle of fish Nutrition. Ellis Horwood Limited, England.
[15] SNI 1999 Seed Goldfish (Cyprinus carpio Linnaeus) class. Majalaya disseminate seed strain. National Standardization Agency / BSN.SNI: 01-6132-1999. Jakarta: 2.
[16] Kordi H and Ghufran M 2009 Aquaculture. Volume 2. PT Citra Aditya Bakti. Bandung.
[17] Saparinto C and Rini S 2013 Successful Seeding 6 Economical type Freshwater Fish. Lily Publisher: Yogyakarta: 278.

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