Growth of *Chanos chanos* with *Artemia* feed fortified vitamin C

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Abstract. Milkfish is one of fishery commodity that has big enough potency to be developed. But there are some obstacles in the development process, which one is feed. Feed becomes one of the limiting factors in milkfish cultivation, especially in hatchery business. Therefore, it is necessary to intensify the milkfish cultivation by using *Artemia salina* in capsule form with vitamin C cultivation as natural food of milkfish at the time of hatchery. The purpose of this study is to know how the effect of feeding *Artemia salina* in capsule form with the addition of vitamin C and to know how the effect of feeding *Artemia salina* in the form of capsules with the addition of vitamins to the growth rate of milkfish seeds. The design used was a complete randomized block design (RAKL) factorial pattern, with 2 treatment factors ie feeding time and *Artemia salina* dose. The data were analyzed using ANOVA at 5% significance and continued with the Smallest Differential Differential Test (DMRT). The result showed that the feeding of *Artemia* with the addition of vitamin C 400 mg/L at 08.00 am increased the average length and weight of milkfish juvenile after treatment compared to others time feeding. On the other hand, the best time feeding for the rate of length and weight of milkfish juvenile was observed at 16.00 pm. In general, it can be concluded that the feeding of *Artemia* with the addition of vitamin C 400 mg/L at 16.00 WIB effectively increased the average length and weight of milkfish juvenile after treatments.

1. Introduction

Milkfish is one of fishery commodity that has big enough potency to be developed. But there are some obstacles in the development process, which one is feed. Feed becomes one of the limiting factors in milkfish cultivation, especially in hatchery business. Feed is generally available in nature, whether phytoplankton, zooplankton or benthos to be utilized by aquatic organisms. Currently, the hatchery only used artificial feed so that the growth of milkfish is inhibited. Therefore, it is necessary to intensive milkfish cultivation by using *Artemia salina* as a natural feed to growth [1].

*Artemia* is a very important natural feed in the hatchery of marine fish, crustaceans, freshwater fish and ornamental fish. *Artemia* has a small size, but it is high nutrition and to the needs of feed on fish [2]. *Artemia* is containing canthaxanthin pigment, protein, vitamin C, and some of fatty acids essential for growth and survival of fish. According to [3], vitamin C required fish for growth of juvenile fish, gonad maturity process, and gamete quality. The content of vitamin C of *Artemia* is 692 ± 89 mg/kg dry weight [4]. Although *Artemia* contains vitamin C, it is still needs to be added vitamin C. Therefore, It is necessary to research to find the best doses of vitamin C fortified in *Artemia* as milkfish feed.
Fish cannot synthesize vitamin C, it is caused by the unavailability of L-gulunolakton as the final-stage reaction of vitamin C synthesis. Therefore, to find the needs of vitamin C required supply of vitamin C from outside. Vitamin C plays a role in promoting growth, overcoming stress, increasing immunity against disease attacks and collagen formation in fish [5]. In addition, vitamin C also plays a role in increasing the growth of juvenile fish. In this case, [6] reported that the addition of vitamin C by enrichment with a dose of 0.1-0.5 ppm on Artemia enrichment media can increase ability and growth of the milkfish juvenile.

2. Materials and Methods

2.1. Materials
In this reseach Artemia is obtained from Bekasi, 120 milkfish juvenile is obtained from hatchery, and vitamin C is obtained from Apotik Agung, Langsa.

2.2. Methods
2.2.1. Artemia hatching
Artemia is hatched in a 1.5 L container of plastic container that has been perforated the bottom and on the cover is connected with aeration hose and flow regulator of water and air. The container is placed upside down and covered with black plastic. The hatching container is filled with 1 L of fresh water and then added 30 g of salt. The addition of salt is done so that the water salinity increases to 30 ppt. Thereafter, 1 g of Artemia as inserted into the hatching container and was aerated hardly for 24 hours so that the Artemia was well stirred. After 24 hours, Artemia harvesting by aeration is switched off and the hose is directed to Artemia sieve by opening the regulator in the hose. The harvested Artemia is then rinsed with fresh water and fed into the enrichment container [7].

2.2.2. Artemia enrichment
Artemia enrichment is used 300 mL plastic container that has been perforated the bottom and on the lid connected with aeration hose and flow regulator of water and air. Then the container is placed upside down. The enrichment container is filled with 200 mL of fresh water and added with 6 g of salt. Then on the enrichment media added vitamin C. Nauplii Artemia that has been harvested with a density of 1 nauplii/mL is put into the enrichment medium and harvested after 10, 12, and 14 hours. In this study used five enrichment containers and one container for Artemia without enrichment. Artemia that has been harvested then rinsed with fresh water and directly given to milkfish juvenile. Artemia enrichment process is done four times a day, while Artemia harvesting is done 12 times a day just before feeding on milkfish juvenile [7].

2.2.3. Maintenance of Milkfish juvenile
The milkfish juvenile were included in the experimental pond that had been prepared with as many as 25 ponds measuring 2 x 2 meters for each experiment. Milkfish juvenile are used age 15 days with the weight of ± 3.2 grams/individu. The Milkfish juvenile are used from hatchery in Kuala Langsa. Each treatment, enter 6 Milkfish juvenile with variation time and natural feed which adjusted for treatments.

2.2.4. Data analysis
Statistical analysis was performed using a randomized block design (RAKL) with five replications. Parameters were analyzed using variance analysis (ANOVA) [8]. If there is a
difference, then proceed with Duncan test. In the research for statistical analysis used Statistical Product and Service Solutions (SPSS) 21.0

3. Results and Discussions
Average length and weight of junivele milkfish with *Artemia* feed fortified vitamin C variation in capsule form are presented in Table 1 and Table 2.

**Table 1.** Average length (cm) junivele milkfish after treatments

| Feeding time | Doses of feeding (mg/L) | Average |
|--------------|-------------------------|---------|
|              | A0 (control)            | A1      | A2      | A3      | A4      |
| T0 (08.00)   | 4.4                     | 4.9     | 5       | 5.6     | 5.4     |
| T1 (10.00)   | 4.3                     | 4.6     | 4.7     | 4.6     | 4.8     |
| T2 (12.00)   | 4.3                     | 4.6     | 4.7     | 4.7     | 4.8     |
| T3 (14.00)   | 4.4                     | 4.8     | 4.9     | 5.0     | 5.2     |
| T4 (16.00)   | 4.6                     | 5.1     | 5.8     | 6.3     | 7.4     |
| 3 Week       |                         |         |         |         | 5.84a   |
| Average      | 4.4b                    | 4.8b    | 5.02b   | 5.24a   | 5.52a   | +       |
| T0 (08.00)   | 8.3                     | 9.6     | 10.3    | 11      | 11.2    |
| T1 (10.00)   | 8.6                     | 9.2     | 9.4     | 9.5     | 9.6     |
| T2 (12.00)   | 8.9                     | 9.2     | 9.6     | 9.7     | 9.9     |
| T3 (14.00)   | 9.0                     | 9.4     | 9.8     | 9.9     | 10.5    |
| T4 (16.00)   | 9.2                     | 10.5    | 12.6    | 15.7    | 19.6    |
| 6 Week       | 8.8e                    | 9.58d   | 10.34c  | 11.16b  | 12.16a  | +       |
| T0 (08.00)   | 16.6                    | 19.2    | 20.7    | 22.1    | 22.5    |
| T1 (10.00)   | 17.5                    | 18.4    | 18.7    | 19.1    | 19.4    |
| T2 (12.00)   | 17.7                    | 18.5    | 19.3    | 19.5    | 19.8    |
| T3 (14.00)   | 18.5                    | 18.7    | 19.6    | 19.8    | 21.3    |
| T4 (16.00)   | 18.5                    | 21.6    | 25.2    | 31.4    | 39.2    |
| 9 Week       | 17.76d                  | 19.28c  | 20.7c   | 23.38b  | 24.44a  | +       |

**Table 2.** Average weight (gr) junivele milkfish after treatments

| Feeding time | Doses of feeding (mg/L) | Average |
|--------------|-------------------------|---------|
|              | A0 (kontrol)            | A1      | A2      | A3      | A4      |
| T0 (08.00)   | 13.22                   | 14.6    | 16.42   | 17.86   | 20.12   |
| T1 (10.00)   | 12.92                   | 14.6    | 15.58   | 17.62   | 19.01   |
| T2 (12.00)   | 12.8                    | 13.22   | 16.42   | 17.86   | 19.52   |
| T3 (14.00)   | 12.92                   | 13.18   | 16.42   | 17.62   | 19.42   |
| T4 (16.00)   | 13.76                   | 14.6    | 18.58   | 19.4    | 23.44   |
| 2 Week       | 13.124d                 | 14.04d  | 16.081c | 18.07b  | 20.30a  | +       |
| T0 (08.00)   | 39.66                   | 43.8    | 49.26   | 53.58   | 60.36   |

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Based on data from table 1 and table 2, it was found that the feeding of Artemia with the addition of vitamin C 400 mg/L at 08.00 am increased the average length and weight of milkfish juvenile after treatment compared to others time feeding. On the other hand, the best time feeding for the rate of length and weight of milkfish juvenile was observed at 16.00 pm. This result could be explained that Artemia is a natural feed of fish which increases the growth. In addition, vitamin C in Artemia contributes to increasing the nutrition of Artemia, so that can increase milkfish juvenile growth, overcome stress, improve reproduction, and increase immunity against disease. The addition of vitamin C in the fish feed has an important role, because the fish are cannot synthesize vitamin C, which is caused by the unavailability of L-gulunolakton as the final reaction of vitamin C synthesis. Therefore, to find the needs of vitamin C required supply of vitamin C from outside for increase the growth of milkfish juvenile. In this case, [6] reported that supplementation of vitamin C by enrichment with a dosage of 0.1-0.5 ppm on Artemia enrichment media can increase the survival rate and growth of milkfish juvenile. Vitamin C is also a micronutrient that plays a role for lysine hydrolysis and proline to make hydroxyproline which is essential for collagen formation. Collagen is a type of protein in the body amounts to between 20-35% of the total body protein. Deficiency of vitamin C caused growth inhibited, skin discoloration, fins and skin erosions, and gill filament damage that can lead to high mortality rates [9]. Feeding behavior of milkfish juvenile was done at 08.00 am-04.00 pm. It is caused milkfish juvenile is diurnal species and milkfish juvenile could not feed in the dark. However, the effective time was at 4:00 pm which occurs turbid due to move the flow of water in the pool. This water dense results in fish rising to the surface of the pond so that it becomes an effective time for feeding.

4. Conclusions
In general, it can be concluded that the feeding of Artemia with the addition of vitamin C 400 mg/L at 16.00 WIB effectively increased the average length and weight of milkfish juvenile after treatments.

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