The Discontinuous Feeding Effects of *Chlorella vulgaris* Supplemented Feed on the Gourami Body Composition

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**Abstract.** *Chlorella vulgaris* is a green alga rich in nutrients. Research on supplementing the alga into the fish feed (4 g/kg) fed discontinuously to gourami (*Osphronemus goramy* Lac.) was conducted. The purposes of this study were to determine the body composition of gourami intermittently fed with *C. vulgaris* supplement and to obtain the best treatment for the fish body composition. Twenty-four fish were separated into four treatment groups, with three replicates. These consisted of control, daily fed fish (C), once a week fasted fish (P1), twice a week fasted fish (P2), and three times a week fasted fish (P3). The experiments were conducted for 56 days. Data on body composition were measured at the end of the study. The results showed that the feeding of *C. vulgaris* supplement of 4 g/kg feed could improve the gourami body composition. The fish that fasted for two days a week demonstrated the best body composition. The success of gourami cultivation is mostly determined by the feed given to increase the nutritional value of the body. Thus, in cultivation, gourami was suggested to feed with a *C. vulgaris* supplement of 4 g/kg and fasted two days a week.

1. Introduction

*Chlorella vulgaris* is a unicellular microalga that lives in freshwater, brackish, and saltwater. This alga contains chlorophyll, so it is called photosynthetic green algae. *C. vulgaris* is rich in nutrients, containing 51-58% protein, 2-22% fat, 12-26% carbohydrate, essential amino acids, thiamin, riboflavin, niacin, Ca, P, Fe, carotene, vitamin B6, vitamin B12, vitamin E [1], and other nutritional substances [2, 3]. These microalgae have chlorophyll [4], and can be used as feed supplements [5]. This algae is one of single-cell phytoplankton used as a protein source and contains Chlorella Growth Factor (CGF), which can stimulate growth and repair tissue damage and activate the immune system [6].

It is reported that *C. vulgaris* contains high protein, carbohydrates, and nucleic acids [7]. Another report also claims that *C. vulgaris* contains high lipids [8]. *Chlorella* sp. are algae with round or ovoid cell shapes and diameters between 2-8 µm. These green algae can move very slowly, so that when they are observed as if they stay still. Phytoplankton has been used as natural food for sea cucumber larvae and pearl larvae. Because of its high nutritional content, *C. vulgaris* is potential for food supplements in animals, including gourami.

Gourami (*Osphronemus goramy* Lac.) is a freshwater fish that can reach a weight of 5 kg, thus, also known as giant freshwater fish. This fish is very popular in society because of its savory, white meat and large thorns. Therefore, many fish farmers cultivate this species. The price of gourami in a market is quite high, and consumer demand for the fish is high.
Cultivation of gourami is simple because it can live in ponds with limited land, tarpaulin ponds, and ponds without water circulation because gourami has a plate to take oxygen directly from the air called labyrinth plate. The crucial limiting factor in gourami cultivation is temperature and rainfall. In low temperatures, gourami mortality occurs larvae, seeds, and even adults. At low temperatures and high rainfall, the parent fish is also rarely spawned.

Gourami growth is relatively slow. It takes 18 months to reach a size of 500 g [9]. Fast-growing can be produced by feeding the fish with high nutrition. High nutrition feed is expected to improve fish body composition. The composition of the gourami body reflects the nutritional value contained in gourami meat. Therefore, this study of supplementation of C. vulgaris on the gourami feed given discontinuously was carried out. The purposes were to determine the fish body composition that fed intermittently with supplementation of C. vulgaris, and to obtain the best treatment of the feeding indicated by an increase in the body composition of gourami.

2. Methods

Twenty-four fish were separated into four treatment groups, and three replicates. These consisted of control, daily fed fish (C), once a week fasted fish (P1), twice a week fasted fish (P2), and three times a week fasted fish (P3). The study was conducted experimentally for 56 days. The gourami used were from spawning a pair of parents, aged three months. The feed given was feed supplemented with C. vulgaris 4 g/kg commercial pellets.

The gouramis were placed in 12 fiber aquaria with a density of two gouramis per aquarium. Gourami is placed in a fiber aquarium randomly, then acclimated for a week. Before treatment, they were fasted for one day (at the end of the acclimation), and the initial body weight was measured to determine the feed weight that would be given each day. Then, they were ready for treatments.

C. vulgaris supplementation in the feed was carried out using the following protocol: 100 mL of distilled water was placed into a sprayer, then 4 g of C. vulgaris was added, shaken to homogenize. As much as 1 kg of commercial pellets was set on the tray, the C. vulgaris solution was sprayed evenly on the pellets while slowly turning, and sun-dried. After drying, they were cooled at room temperature, then store closed tight container. The feed was ready to be tested on gourami.

Feed treatment was given twice a day, in the morning and evening (08.00 and 16.00 local time) for 56 days, as much as 5% of the gourami bodyweight. Every two weeks, their weights were measured to adjust the amount of feed given.

Proximate feed analysis was carried out at the beginning of the study to determine the composition of the feed given. Feed supplementation of C. vulgaris 4 g/kg commercial pellets was smoothed using a blender. The nutritional composition of the feed was analyzed at the Faculty of Animal Husbandry, Jenderal Soedirman University, Purwokerto.

Body composition analysis was done to the gourami from each treatment. The dishes were placed on labeled Petri dishes and dried in an oven (70 °C). The dried gourami was mashed using a blender, and their body composition was analyzed at the same faculty as feed analysis. The data were analyzed by analysis of variance (ANOVA) and body composition data was presented in a table (mean ± SD).

3. Results

3.1. Composition of Gourami Feed

The proximate analysis of the composition of feed of gourami supplemented with C. vulgaris dose of 4 g/kg of commercial pellets is shown in Table 1.
Table 1. Composition of Gourami Feed

| No | Parameter | Feed Composition (%) |
|----|-----------|----------------------|
| 1  | Water     | 8.86                 |
| 2  | Protein   | 40.57                |
| 3  | Lipid     | 4.68                 |
| 4  | Fiber     | 9.18                 |
| 5  | Ash       | 9.13                 |
| 6  | BETN      | 36.44                |

3.2. Gourami Body Composition with Experimental Diets

The results of the proximate analysis of the body composition of gourami is presented in Table 2.

Tabel 2. Gourami Body Composition with Experimental Diets.

| Parameter (%) | Treatments |
|---------------|------------|
|               | P0         | P1         | P2         | P3         |
| Water         | 9.17 ± 0.028 | 8.1 ± 0.113 | 5.71 ± 0.099 | 4.44 ± 0.17 |
| Protein       | 54.19 ± 0.106 | 54.96 ± 0.085 | 55.36 ± 0.304 | 56.76 ± 0.042 |
| Lipid         | 22.13 ± 0.042 | 17.85 ± 0.035 | 14.41 ± 0.226 | 23.37 ± 0.049 |
| Fiber         | 2.99 ± 0.148  | 1.53 ± 0.191  | 1.82 ± 0.163  | 3.53 ± 0.035  |
| Ash           | 12.94 ± 0.141 | 9.26 ± 0.035  | 9.76 ± 0.049  | 9.86 ± 0.141  |
| BETN          | 7.91 ± 0.148  | 16.5 ± 0.233  | 18.49 ± 0.431 | 6.7 ± 0.191   |

4. Discussion

4.1 Composition of Gourami Feed.

Feed with *C. vulgaris* supplementation 4 g/kg of feed contained 40.57% protein and 4.68% fat. The protein and fat contents in the feed indicate that the feed given to gourami has a high nutritional value. Giving feed with high nutritional value would increase body composition. Increasing body composition suggests that feeding with high nutritional value can also increase the nutritional value of the gourami body.

If protein, mixed with non-protein and starch material, it would be able to enrich the nutritional value of the feed [10, 11]. Changes in the level of synthesis and deposition in the muscle are related to changes in fat and protein content in the fish body [12, 13].

4.2. Gourami Body Composition with Experimental Diets

The body composition measurements showed that supplementation of *C. vulgaris* 4 g / kg feed could increase the percentage of gourami body protein from an average of 54.19 ± 0.106 in control and the highest in the treatment of three days a week, 56.76 ± 0.042. The lowest percentage of body fat in the twice a week fasted treatment with an average of 14.41 ± 0.226 and the highest in three times a week fasted treatment with an average of 23.37 ± 0.049.

An increase in body composition also followed the improved feed supplementation. Feeding *Spirulina platensis* 6 g/kg feed significantly improves the body composition of gourami fish. It can be seen in the protein composition and body fat [14].

The results demonstrated that the supplementation of *C. vulgaris* in feeding gourami could improve the body composition of gourami fish. It is consistent with the study reporting the addition of green-blue algae to the base of Hybrid Red Tilapia feed could increase the proximate composition of carcasses [15]. Fish body composition that was fasted were significantly different from controls in the content of protein, lipids, ash, moisture, and energy. These results are consistent with results in barramundi [16, 17], Chinese long snout catfish [18], and large sturgeon [19] about lipids, energy, and...
water content. Carcass analysis showed significantly higher dry matter and crude protein content, but lower lipid content in Nile Tilapia (*Oreochromis niloticus*) received *Chlorella spp.* at 50% level, compared to other treatments (0, 10, 25, and 75% substitution) [20].

In contrast to other studies, the treatment of satisfaction has not provided a significant difference in fish body composition [21]. Research on differences in the cycles of starvation and refeeding on the European Sea Bass (*Dicentrarchus labrax*) found the lowest fat content in the treatment cycle of 10 days of starvation / 40 days of satiation. Several other researchers also reported that the composition of the body's lipids would decrease due to the treatment of satisfaction [16, 22- 24].

5. Conclusion

The feeding of *C. vulgaris* supplement of 4 g/kg feed could improve the gourami body composition. The fish that fasted for two days a week demonstrated the best body composition. The success of gourami cultivation is mostly determined by the feed given to increase the nutritional value of the body. Thus, in the cultivation, gourami is highly recommended to be fed with *C. vulgaris* supplement of 4 g/kg feed, twice a week fasted.

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