

Effects of Photoperiods on the Growth Performance of Juvenile *Trichogaster lalius* (Hamilton, 1822)

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Abstract. Juvenile of *Trichogaster lalius* was reared under three photoperiod conditions (0L:24D, 12L:12D, 16L:08D) for 60 days to examine the growth performance under laboratory conditions. The maximum growth was observed in the juvenile of *T. lalius* exposed to 16:00 hrs. light. The mean body weight of different groups of juvenile fish exposed to different light conditions were significantly different ($p < 0.05$) from each other which was observed from 20th day of the experiment. The absolute, specific, and relative growth rates were found to be maximum in the group exposed to 16:00 hrs. light duration. The present study indicated that 16:00 hrs. light duration was considered to be better for the growth of juvenile of *T. lalius* under controlled condition.

Introduction

Dwarf gourami, *Trichogaster lalius* is an inland water teleostean fish of great economic importance. As an ornamental fish, it fetches a good price in the market. Colour is considered to be one of the major factors which determine the cost of aquarium fish in the world market [1].

Environmental and nutritional factors play an important role in the development of various stages of fish. The factors that affect the growth of fish are feeding rate, feeds, water quality, stock density and size [2]. The physical factor such as photoperiod is known to increase the growth and survival rate of juvenile fish [3] particularly in temperate regions through processes such as photo stimulation, feed intake which improves the feed conversion efficiency [4-6]. Studies on the use of light intensities in different fish species have been carried out by many workers, notable among them are [7-15]. Simensen et al. [16] pointed out that photoperiod act as a zeitgeber that controls growth. A number of workers reported a relationship between photoperiod and growth rate in different species of fish and concluded that application of optimum photoperiod can raise the yield of fish in aquaculture [17-20]. A survey of literature indicated the paucity of information on the effects of photoperiods on the growth of juvenile of *T. lalius*. Therefore, the present study was conducted to examine the effects of different photoperiod regimes on the growth of *T. lalius*.

Materials and Methods

Experimental Setup

A total of 90 specimens of *T. lalius* of uniform size were collected from a pond situated at Lucknow (26° 56' N 80° 43' E) using cast and drag nets. Fish were acclimatized to laboratory conditions for ten days before starting the experiment. The weight of the each fish was taken with the help of a single pan balance sensitive up to 0.01g (Kerro, Taiwan). The experiment was conducted for 60 days in nine aquaria (0.45x0.22x0.30m) in triplicates where ten specimens were kept in each aquarium. Water volume of 15 litres was maintained in each tank which was equipped with an aerator supported by an air pump and filter. Fish were fed with artificially prepared balanced food comprising of 35% fish meal, 28% mustard oil cake, 28% rice barn, 2% each

sunflower and cod liver oils, 5% carboxy methyl cellulose and multivitamin-multimineral tablets (Becozyne Forte Glaxo India Ltd, 25 tablets/kg food) throughout the investigation period. Fish were fed once in a day equivalent to 5.0 % of their body weight and fecal matter was removed daily.

Illumination and Experimental Paradigm

After acclimatization, 90 juvenile of *T. lalius* were randomly selected and divided into three major groups of 10 individuals and each group was exposed to either of the following photoperiodic regime:

- (a) Continuous dark (0L:24D) of 0 hour light group
- (b) Short photoperiod (12L:12D) of 12 hours light group
- (c) Long photoperiod (16L:08D) of 16 hours light group.

The all aquaria were separated from each other by light-proof devices. Artificial white fluorescent lamps of 40 watt each were installed at a height of 15 cm above the water level. The intensity of light at the surface of the water in each tank was about 200 lux. Different switches operated by ready programmed electronic timers separately determined the duration of illuminations in different tanks. The physico-chemical conditions such as ambient temperature, dissolved O₂ and pH of water for different groups were maintained constant throughout the study. Each rectangular aquarium with an artificial photoperiod regime was enclosed with black sheets in order to prevent the escape of light from aquaria. All the aquaria were kept in the dark room separately to isolate them from natural light. The initial mean weight of fish exposed to the two light regimes and darkness were 0.8500 ± 0.4323 , 0.8350 ± 0.4694 and 0.8053 ± 0.3535 for, 16L:08D, 12L:12D and 0L:24D respectively. Feeding schedules and photoperiod duration are given in Table 1.

Table 1. Feeding schedule and photoperiod duration of the experiment.

S. No.	Light on	Light off	Photoperiod duration
1.	12:00 hrs.	12:00 hrs	12L:12D
2.	18:00 hrs.	10:00 hrs	16L:8D
3.	Never	Always	0L:24D

Sampling and Analysis

The weight of each individual specimen of fish was recorded at the beginning and every fortnightly during the experiment. No any feed was given on the day when weighing was taken. Daily feed intake (DFI), absolute growth rate (AGR), specific growth rate (SGR), relative growth rate (RGR) and weight gain of all specimens of each group of fish was calculated using following equations:

1. Daily Feed Intake (g/fish) = Wet feed intake (g)/Number of fish /day
2. Absolute Growth Rate (g/day) = Final mean weight (g)–Initial mean weight (g)/rearing period(days)
3. Relative Growth Rate (%) = [(Final mean weight(g) – Initial mean weight(g)) / Initial mean weight] x 100
4. Specific Growth Rate (%) = [ln (Final mean weight) – ln (Initial mean weight) / Rearing period (days)] x 100
5. Weight Gain (%) = [(Final mean weight – Initial mean weight) / Initial mean weight] x 100

The statistical significance of differences between measured parameters was computed using one way ANOVA. All calculations were done with the help of Graph Pad Prism 5.

Results

Mean final AGR, RGR, SGR and weight gain were maximum in group subjected to sixteen hours photoperiod (16L:08D) and their means were significantly different ($p < 0.05$) from other group of fish of different photoperiod regimes (Table 2). Maximum value of daily feed intake was recorded in group subjected to sixteen hours photoperiod but their means were not significantly different from other group of fish subjected to different photoperiod regimes. Maximum growth was observed in the group of fish which was exposed to sixteen hours light followed by fish kept in 12L:12D and minimum in 0L:24D. Maximum mean body weight recorded in the group exposed to sixteen hours light during 60 days experiment (Fig. 1). Mean body weight in sixteen hrs. exposed photoperiod groups was significantly different ($p < 0.05$) from other groups after 20th day and continued till the end of the experiment (Table 3). Minimum growth was observed in fish kept in dark (0L:24D). The mean final weight recorded in three groups of fish exposed to different light regimes and darkness was 1.5214, 1.0416 and 0.8846 for 16L:8D, 12L:12D and 0L:24D respectively.

Table 2. The growth indices of juvenile *T. lalius* under different photoperiod regimes.

Control	0L: 24D	12L: 12D	16L: 08D
DFI	0.0061 ^a	0.0080 ^a	0.01704 ^a
AGR	0.0321 ^a	0.1053 ^a	0.1153 ^b
RGR	5.6465 ^a	16.2366 ^a	56.4334 ^b
SGR	0.0678 ^a	0.20897 ^a	0.6367 ^b
Weight Gain	321.89 ^a	998.923 ^a	3261.7 ^b

The different subscript in the same row are significant different ($p < 0.05$) where 'a' denotes non significance and 'b' denotes significant relationships.

Table 3. Mean body weight (mean±standard deviation) of all groups subjected to different photoperiod regimes.

Days	0L: 24D	12L: 12D	16L: 08D
0 day	0.8053 ± 0.3535 ^a	0.8350 ± 0.4693 ^a	0.8500 ± 0.4322 ^a
After 20 days	0.8214 ± 0.2806 ^a	0.9051 ± 0.2461 ^a	1.1105 ± 0.3680 ^b
After 40 days	0.8461 ± 0.2221 ^a	0.9642 ± 0.3499 ^a	1.3571 ± 0.4552 ^b
After 60 days	0.8846 ± 0.3632 ^a	1.0416 ± 0.1729 ^a	1.5214 ± 0.4822 ^b

The different subscript in the same row are significant different ($p < 0.05$) where 'a' denotes non significance and 'b' denotes significant relationships.

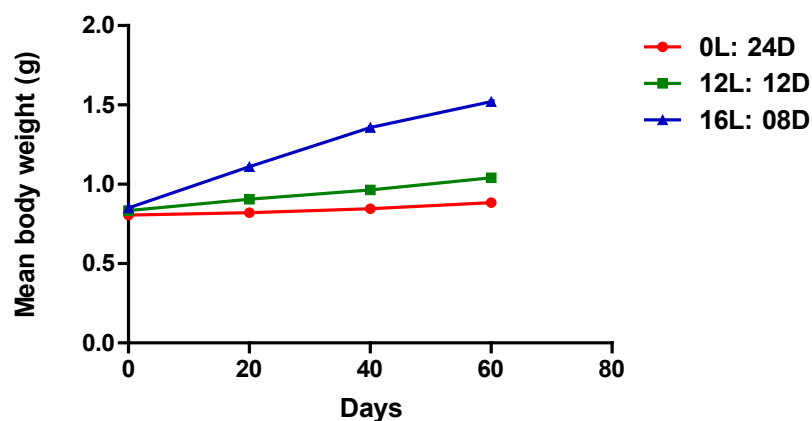


Figure 1. Mean Body Weight of juvenile of *T. lalius* exposed to different photoperiod regimes.

Discussion

The findings of the present study showed that the growth of juvenile of *T. lalius* is affected by photoperiod treatments and optimum photoperiod regime was found to improve the growth of fish. A number of workers such as [3, 22, 23] emphasized that photoperiod requirement is an important variable and related to environmental adaptation, species and age specific. Working on influence of photoperiods on growth, feed consumption and survival of juvenile of mirror carp, Yager and Yigit also reported highest growth in the group subjected to high regime of photoperiod [24]. Similar results were reported by many workers such as [7, 10, 11, 25-27] in various fish species.

The mean body weight of the 16 hrs. group was found to be significantly different from the other two groups; however, this difference was noticed from the 20th day of the experiment and continued till the end of the experiment. Similarly, differences in AGR, SGR, RGR and weight gain were noticed after 20th day onwards, which also suggested that the juvenile stage of *T. lalius* requires several weeks to acclimatize to new rearing conditions. The present finding is similar to that of the study carried out by [28] on Baltic salmon and brown trout which required several weeks to acclimatize to new rearing conditions.

Working on the effects of light on growth and development of fish, several workers such as [29-31] reported that appetite, food conversion and growth were dependent on the secretion of growth hormone, and concluded that feeding activity regulated by light and dark cycle. A sixteen hours photoperiod in the present study was found to be suitable for the growth of juvenile of *T. lalius* for their culture under controlled conditions. This is so because feeding activity is regulated by the light: dark cycle and high growth rate under sixteen hours photoperiod regime in juveniles of *T. lalius* in the present study is because of increased feed intake. The increased light hours shows better growth because of high feed conversion ratio (FCR) under continuous photoperiod [11]. Similarly, higher daily growth was recorded under 16L:8D photoperiod in Gilthead sea bream [32].

Conclusion

In the present study, longer photoperiod (16 hours photoperiod) was found to be suitable for the growth of juvenile of *T. lalius* for their culture under controlled conditions.

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