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LABEO DYOCHEILUS FINGERLINGS FEED CONVERSION RATIO, SURVIVAL AND GROWTH IS AFFECTED BY WATER TEMPERATURE

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ABSTRACT

Present study was conduct to explore the effect of different water temperature ranges on growth performance, total length and feed conversion ratio of *Labeo dyocheilus*. For that the three temperature ranges 16-18°C, 18-20°C and 20-22°C were selected and maintained in laboratory condition in glass aquaria. Each experiment repeated three times to minimise experimental error for each water temperature range. The feed was offered at the rate of 4% of body weight of the fish one time in a day. *Labeo dyocheilus* attained significantly higher body weight (12.260 ± 0.256g) and total length (11.898 ± 0.073 cm) under water temperature range of 20-22°C. This was followed by 11.813 ± 0.203g body weight and 11.789 ± 0.110 cm total lengths under water temperature range of 18-20°C and 11.436 ± 0.162g and 10.325 ± 0.178 cm for body weight and total length respectively for the water temperature range of 16-18°C. The fish reared in water having temperature between 20-22°C showed the best FCR value (2.324 ± 0.167), followed by those maintained in 18-20°C (2.760 ± 0.132) and 16-18°C (3.018 ± 0.173). It was concluded that water temperature ranging from 20-22°C seems to be the most effective for rearing of *Labeo dyocheilus*.

Keywords: Water temperature, Growth, Feed Conversion Ratio, *Labeo dyocheilus*.

INTRODUCTION

A considerable amount of research has been conducted on the relationship between temperature and physiological processes of fishes. Fishes are poikilotherms, which mean that their body temperature changes as water temperature changes. Different fish species vary in there tolerances to water temperature and each species has an optimum temperature for growth [1]. Fish generally show temperature optima for growth and survival [1, 2]. Each fish species has an ideal temperature range within which it grows quickly. Growth and live ability in fish are optimum within a defined temperature range [2]. Freshwater fish have an optimum growing temperature in the range of 25-30^{o}C [3]. Water temperature influences the body temperature, growth rate, food consumption, feed conversion and other body functions [2, 4, 5]. Therefore, water temperature is a driving force in the fish life because its effects are more than any other single factor. High water temperatures increase the metabolic rates, resulting in increased food demand. Even temperature has been shown to be a major factor affecting geographic distribution of fishes [6, 7]. During winter, temperature falls, thus influencing biological functions in fish. The optimal temperature for growth is usually higher than the temperature the species meet in nature [8, 9]. Optimal temperature for feed conversion efficiency is generally lower than optimal temperature for growth [10-12]. Increased or decreased water temperature can be lethal or sub-lethal and may alter metabolism and growth, because most fish lack a system to maintain body temperature [13, 14].

Labeo dyocheilus is an important cultured freshwater fish in India, Therefore, growth rate of this fish and other cultured freshwater carps decreased during the

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low water temperature period. Keeping in view the information given above, it can be envisaged that by understanding how temperature affects the performance of fish, particularly during winter season, a farmer can maximize his profit by exploiting maximum production potential of local fish species. However, information regarding the effect of water temperature on various species of fish in India is limited. Therefore, this study was designed to investigate the effect of different temperature ranges on the growth performance and feed conversion ratio of *Labeo dyocheilus*.

METHODOLOGY

Sixty *Labeo dyocheilus* fingerlings obtained from western Ramganga at Chaukhutia (Latitude: 29° 53' 55" N and Longitude: 79° 21' 22" E). Six weeks experiment was conducted in six glass aquaria in laboratory. Fingerlings were randomly stocked in each aquarium having water at three temperature range of 16-18°C, 18-20°C, 20-22°C. The average initial body weight of the fingerlings was 9.60 g and total length was 8.42 cm. An experimental diet was given to fingerlings about 4% of wet body weight of the fingerling once a day in feeding aquaria and remaining feed was collected after 3 hours. Different component of experimental food were (Vitamins 1%, Green algae 3.5%, Fish oil 10%, Soybean meal 12.5%, Blood meal 30 %, Rice polishing 43%). Mean wet body weight of the fingerlings in each aquarium was calculated to work out the feeding rate for the next week. The data on feed consumption and body weight gain were used to calculate feed conversion ratio [15]. The differences in the means were compared by Duncan's multiple range test series, procedure described by Steel *et al.* [16].

RESULTS

Labeo dyocheilus gained higher body weight 12.260± 0.256g under water temperature range of 20-22 °C. The next higher weight of fish was 11.813 ± 0.203g and 11.436 ± 0.162g in water temperature ranges of 18-20°C and 16-18 °C, respectively. The comparison of means of body weight in different water temperatures indicated that three water temperature ranges significantly affected the average body weight gain of the fish. *Labeo dyocheilus* attained higher total length (11.898± 0.073 cm) under temperature range of 20-22°C, followed by 18-20°C (11.789 ± 0.110 cm) and 16-18°C (10.325 ± 0.178 cm). The analysis of the data revealed that the temperature of water significantly influenced the total length of the fish. The interaction between weeks and water temperature in respect of total length gain was also significant. The comparison of means of total length on different water temperatures indicated that all three temperature ranges differe significantly from one another. The fish kept in water having temperature between 20-22°C showed better FCR value (2.324 ±0.167), followed by 18-20°C (2.760 ± 0.132) and 16-18°C (3.018 ± 0.173). These results showed that temperature of the water significantly influenced the feed conversion values of the fish. However, the interaction between weeks and water temperature in respect of feed conversion ratio was non-significant. Mean values of feed conversion ratio under three water temperature ranges were found to be significantly different from one another. (Table 1, 2 and 3).

Table 1. *Labeo dyocheilus* growth and FCR comparison in temperature range 20 to 22 ^{0}C

	Experimental temperature range-I 20 to 22 ^{0}C				
S. No.	**Time duration**	**Total Length (cm)**	**Body weight (gm)**	**FCR**	**Mean of FCR**
1	Initially	8.234±0.120	9.321±0.132	Not taken	
2	First week	8.872±0.238	10.567±0.186	2.260±0.127	
3	Second week	8.987±0.154	10.437±0.176	2.280±0.092	
4	Third week	9.671±0.187	11.875±0.183	2.298±0.051	2.324±0.167
5	Fourth week	9.982±0.129	11.972±0.178	0.327±0.067	
6	Fifth week	10.945±0.122	12.369±0.125	2.370±0.038	
7	Sixth week	11.898±0.073	12.260±0.256	2.390±0.028	

Table 2. *Labeo dyocheilus* growth and FCR comparison in temperature range 18 to 20 ^{0}C

	Experimental temperature range-II 18 to 20 ^{0}C				
S. No.	**Time duration**	**Total Length (cm)**	**Body weight (gm)**	**FCR**	**Mean of FCR**
1	Initially	8.465±0.073	9.600±0.157	Not taken	
2	First week	9.240±0.154	9.948±0.193	2.662±0.255	
3	Second week	9.369±0.179	10.297±0.181	2.717±0.170	
4	Third week	9.489±0.121	10.667±0.162	2.753±0.174	2.760±0.132
5	Fourth week	10.334±0.167	11.003±0.142	2.802±0.178	
6	Fifth week	10.965±0.371	11.439±0.122	2.854±0.199	
7	Sixth week	11.789±0.110	11.813±0.203	2.920±0.171	

Table 3. *Labeo dyocheilus* growth and FCR comparison in temperature range 16 to 18 ^{0}C

	Experimental temperature range-III 16 to 18 ^{0}C				
S. No.	**Time duration**	**Total Length (cm)**	**Body weight (gm)**	**FCR**	**Mean of FCR**
1	Initially	8.710±0.176	9.545±0.163	Not taken	3.018±0.173
2	First week	8.935±0.142	9.823±0.046	2.855±0.178	
3	Second week	9.199±0.114	10.141±0.121	2.921±0.171	
4	Third week	9.464±0.102	10.489±0.200	2.956±0.106	
5	Fourth week	9.736±0.121	10.792±0.027	2.934±0.114	
6	Fifth week	10.115±0.150	11.210±0.149	3.062±0.157	
7	Sixth week	10.325±0.178	11.436±0.162	3.180±0.103	

DISCUSSION

Growth rate, food intake and feed efficiency ratio of juvenile *Labeo dyocheilus* was significantly influenced by temperature and fish size, a linear relationship between specific growth rate and temperature has also been stabilized in Atlantic salmon [17]. Temperature is related to fish growth because it influences fish metabolism since water temperature affects the rate of enzyme activity, mobility of gases, diffusion and osmosis [1]. In our study the weight gain increased with increase in water temperature. These results support the earlier findings that growth and survival of fish are optimum within a defined temperature [2]. Generally there is a positive exponential relationship for many species of fish between standard metabolism and temperature [18]. As temperature increases, standard metabolism increases [19]. The highest weight gain was observed in the *Labeo dyocheilus* maintained on 20-22 °C. Fish were markedly influenced by the temperature of water in which they lived [20, 21, 22]. Increased growth has also been reported in *Labeo* reared at average temperature of 19°C as compared with those in outdoor tanks at average temperature of 14.8°C [23]. An increase in temperature increases the activity of digestive enzyme, which may accelerate the digestion of the nutrients, thus resulting in better growth [24]. 40% increase in growth rate of Cod reared at 8.3°C compared with 4.5°C [25]. Growth rate increase about 50% with each 4°C increase from temperature between 6 to 14°C [26]. However, different fish require different temperature regimes; a range between 20-22°C being the optimum for *Labeo dyocheilus*. Optimum temperature for best growth of European catfish *Silurus glanis* was within the range of 25 to 28°C with best results noted at 27°C [27].

The results of the present study was that *Labeo dyocheilus* maintained less body weight under low temperature (16-20°C) as compared to the other treatment groups. The present findings were in line-with an observation that, rapid decrease in growth rate when temperature reached 18.9 °C [28]. The lower body weight of the *Labeo dyocheilus* maintained in low water temperature (16-20°C) may be due to less feed intake than those kept under higher water temperature (20-22°C). Our results was supported by a study that, most species cease to feed at low temperatures (below 16°C) [29]. Our finding is also supported by a laboratory study, who reported that, in low temperature fingerlings growth was less as compare to high temperature [30]. Therefore, better growth rate at 20-22°C in *Labeo dyocheilus* may be attributed to the high water temperature, which increased the feed intake and metabolic rate of the fish.

In the present work relationship between temperature and food consumption ratio (FCR) was also observed. Relationship between temperature and food consumption in golden shiners were also studied [31]. The best FCR was observed in the fish kept at 20-22°C temperature range, followed by those maintained at 18-20°C and 16-18°C. These results are consistent with findings that, *Ictalurus Punctatus*, fingerlings reared at a temperature range of 18-34°C registered improvement in FCR, with the best values obtained at 30°C [32]. Better efficiency of feed in fish reared at high temperature than those kept at low temperature 17-27°C [33]. In literature relationship between temperature and food consumption, find positive relation between them in various fishes [34-36]. Increase in temperature resulted in better utilization of feed in fish than those kept under lower temperature 20.9-24.3°C [37]. Better feed conversion ratio of the fish maintained at 24-26°C in this study may be attributed to the increased feed intake of the fish, which spared more nutrients for growth of the fish after meeting the maintenance requirements.

CONCLUSION

In conclusion, water temperature ranging from 20-22°C seemed to be the most effective for rearing of *Labeo dyocheilus*. However, the effect of water temperature on nutrient digestibility of the diet fed to the *Labeo dyocheilus* still remains an important factor, which might play an important role in understanding the growth performance of the fish.

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