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Influence of Different Feeding Rate on Growth Performance and Survival Rate of Grass Carp (*Ctenopharyngodon idella)*

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Abstract: This study (at 60 days) was carried out to evaluate the effect of different of body weight on growth performance and survival rate of juvenile grass carp (*Ctenopharyngodon idella*). Six groups of juvenile grass carp (average weight 6.2±0.1 g) were fed by *Lemnea* sp. (2 times a day) with 10 percent of body weight (T1), 20 percent of body weight (T2), 30 percent of body weight (T3), 40 percent of body weight (T4), 50 percent of body weight (T5) and 60 percent of body weight (T6) with three replicates of each treatment combination were applied in this experiment. Different percentages of feed showed different growth performance in treatments and results clearly showed that fish group fed with 60 percent of body weight (T6) had positive effects on growth performance, however it was not significantly different with T4 and T5 ($P>0.05$). The final body weight (FBW) were significantly higher in treatments T6, T5 and T4 ($P<0.05$) but these treatments (T4, T5 and T6) had not significantly different to each other ($P>0.05$) in this comparison. Similar responses were observed for specific growth rate (SGR). The best body weight gain (BWG) was obtained from T6, however there were no significant difference between T6 and T5 ($P>0.05$). The maximum daily growth rate (DGR) was obtained in T6, which was significantly different compared to other groups ($P<0.05$). Also fish group fed with different percentages of body weight had no positive effect in fish survival rate ($P>0.05$). The best result of growth performance was obtained by feeding 60 percent of body weight (T6) and somewhat in T4 and T5.

Key words: Different Percent of Body Weight % Body Weight Gain % Grass Carp % *Ctenopharyngodon idella*

INTRODUCTION

Grass carp (*Ctenopharyngodon idella*) is a very popular economic fish species cultured in China. There is little information about nutrient requirements and optimum feeding rates of grass carp [1-7]. Feeding rate is important for the growth, feed conversion, nutrient retention efficiency and chemical composition of fish [8-13]. Determination of the nutrient requirements is also affected by feeding rate [14-15]. A restricted feeding rate will cause impaired health [16] or slow growth [11, 17, 18]. Conversely, over-feeding of fish will cause the overload of stomach and intestine, economic loss and decrease the efficiency of digestion and absorption [19] and thus reduces feed efficiency [11, 12]. An optimum feeding rate is helpful to minimize the feed loss, reduce water pollution and decrease cost of aquaculture production. Estimation of an optimum feeding rate is affected by fish size, water temperature, feeding strategy and rearing condition [12, 20, 21]. Vahl [22] suggested that only two parameters were necessary to design an optimal feeding regime in aquaculture system, the maximum voluntary feed intake in one meal and the evacuation rate of the stomach. Some studies, however, show acclimation of fish is also important [23] and short-term feed intake has a limited value in assessing the optimum feeding rate [24]. The optimization of fish production requires research in feeding techniques, which promotes growth and at the same time reduces the quantity of waste products released in the water as reported by Singh *et al*., [25]. According to Erondu *et al*., [26]; Sheunn *et al*., [27] fish feed consist of 60% production cost and the protein component is to be the most expensive in terms of overall feed cost. Increasing protein levels in feeds can lead to improved fish production,

MATERIALS AND METHODS

180 uniform juveniles of grass carp with initial weight, 6.2± 0.1 g were obtained from the Institute of Pond Fish Culture in Gorgan (Agh Ghala), Iran. This experiment was conducted in a completely randomized design with six

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treatments and three replicates per treatment for a total of eighteen fiberglass tanks (each with a capacity of 450 liters). And nine fiberglass tanks were for replacement water. The density of fish per tank was 30 fish. The fish were weighed individually at the beginning, during and at the end of the experiment. Also the water temperature was 19.46±1.23°C, pH was 7.85±0.26 and water oxygen level was maintained above 7.65±0.55 mg L^{-1} during the experiment an electrical air pump (by a single filtration unit). *Lemnea* sp. was obtained in lake from Gorgan (Kordkooy), Iran, Each three days and washed with water and salt and reserved in fiberglass tank and used for all of treatments with base of different percent body weight in six group with 10, 20, 30, 40, 50 and 60 percent of body weight (T1, T2,T3,T4,T5 andT6 respectively). Nutritional compositions of experimental diets (*Lemnea* sp.) are given in Table 1. Proximate composition of diets was carried out using the Association of Analytical Chemists AOAC [28] methods. Protein was determined by measuring nitrogen (N×6.25) using the Kjeldahl method; Crude fat was determined using petroleum ether (40-60 Bp) extraction method with Soxhlet apparatus and ash by combustion at 550 °C.

Growth parameters were calculated as follows: body weight gain (BWG) = final body weight (g)-initial body weight (g). Specific growth rate (SGR) (% BW day^{-1}) = (Ln final body weight (g)-Ln initial weight (g)) / (experimental period) × 100

Table 1: Nutrients composition of experimental diets (%)

Ingredients	%
Protein	28
Lipid	11.4
Fiber	2.7
Ash	6

Feed conversion ratio (FCR) (%) = total fed/body weight increase (g) × 100 Daily growth rate (DGR) = (final body weight (g)-initial weight (g)) × (100) / (experimental period × initial weight) Survival rate = (N_t × 100 $N_0 G^{-1}$)

In order to determine significant differences, results were analyzed by one-way Analysis of variance (ANOVA) and Duncan's multiple range test were used to analyze the significance of the difference among the means of treatments by using the SPSS program.

RESULTS AND DISCUSSION

The results clearly showed that increase the percentage of food had beneficial effects on the growth parameters on grass carp. The feeding and growth parameters of grass carp are presented in Table 2. Effects of higher percentage of food in treatments (T6, T5 and T4) on growth performance and survival rate of grass carp resulted better than lower percentage of body weight treatment (T3, T2 and T1) however there were no clear significantly differences in this comparison ($P>0.05$). The maximums of final body weights (FBW) observed in T6 (10.7±1g) however there were no significant difference between this treatment with T5 (10±1g) and T4 (9.5±0.3g) ($P>0.05$), but T6 was significantly different with T1, T2 and T3 ($P<0.05$). The lowest of FBW was observed in T1 (8±0.3g) and there were not significantly different between this treatment with T2 (8.8±1g), T3 (9.1±1g) and T4 (9.5±0.3g) ($P>0.05$), but T1 was significantly different with T5 and T6 ($P<0.05$).

The maximum body weight gain (BWG) was observed in T6 (4.5±0.9g) however it was not significantly different with T5 (3.8±0.9g) and T4 (3.3±0.2g) ($P>0.05$). The lowest BWG was obtained in T1 (1.8±0.2g) but it was not significantly different to T2 (2.6±0.17g), T3 (2.9±0.9g) and

Table 2: Growth parameters and survival rate of juvenile grass carp (*Ctenopharyngodon idella*) in experimental treatments (trial 1-6)

	Treatments					
Growth Indices	T1	T2	T3	T4	T5	T6
Initial weight (g)	6.2±0.1	6.2±0.1	6.2±0.1	6.2±0.1	6.2±0.1	6.2±0.1
Final body weight (g)	$8±0.3^{c}$	$8.8±1^{bc}$	$9.1±1^{bc}$	$9.5±0.3^{abc}$	$10±1^{ab}$	$10.7±1^{a}$
Body weight Gain (g)	$1.8±0.2^{c}$	$2.6±0.17^{bc}$	$2.9±0.9^{bc}$	$3.3±0.2^{abc}$	$3.8±0.9^{ab}$	$4.5±0.9^{a}$
Specific growth rate for weight (% BW day^{-1})	$0.42±0.03^{c}$	$0.58±0.22^{bc}$	$0.63±0.16^{bc}$	$0.71±0.2^{b}$	$0.79±0.14^{b}$	$0.9±0.12^{a}$
Feed Conversion Ratio (%)	$22.75±2.15^{f}$	$32.52±2.0^{e}$	$45.77±1.0^{d}$	55.27±1.0c	$61.38±1.0^{b}$	$64±1.0^{a}$
Feed Conversion efficiency (%)	$0.044±0.0^{a}$	$0.031±0.0^{b}$	$0.022±0.0^{c}$	$0.018±0.0^{d}$	$0.016±0.0^{ef}$	$0.016±0.0^{f}$
Daily Growth Rate (DGR)	$0.48±0.04^{f}$	$0.7±0.02^{ef}$	$0.77±0.0^{d}$	$0.89±0.01^{c}$	$1.02±0.01^{b}$	$1.21±0.1^{a}$
Survival rate (%)	$93.81±5.71^{a}$	$93.12±4.28^{a}$	$94.18±2.18^{a}$	$94.18±2.18^{a}$	$94.18±2.18^{a}$	$94.18±2.18^{a}$

Groups with different alphabetic superscripts at the same row differ significantly at $p<0.05$ (ANOVA)

T4 (P>0.05). The specific growth rate (SGR) was improved significantly (P<0.05) with increasing the percentage of feeding. The growth data clearly indicated that SGR values of group T6 (0.9±0.12) was significantly higher than those of other treatments (P<0.05), followed by T5 (0.79±0.14) and T4 (0.71±0.2) however they were not significantly different to each other and to T3 (0.63±0.16) and T2 (0.58±0.22) (P>0.05) and the lowest SGR was observed in T1 (0.42±0.03). This is particularly true for daily growth rate (DGR), the highest of DGR was obtained in T6 (1.21±0.1), followed by T5 (1.02±0.01), T4 (0.89±0.01) and T3 (0.77±0.0) and had significantly different to each other (P<0.05). The lowest DGR observed in T1 (0.48±0.04) however it was not significantly different with T2 (0.7±0.02) (P>0.05), also these treatments (T1 and T2) were significantly different to other treatments (P<0.05).The maximum food conversion ratio (FCR) was observed in T6 (64±1.0), followed by T5 (61.38±1.0), T4 (55.27±1.0), T3 (45.77±1.0), T2 (32.52±2.0) and T1 (22.75±2.15) that T1 was the lowest in FCR comparison and all of treatments were significantly different to each other (P<0.05). Also fed with different percentages of body weight on survival rate did not show any significant difference among treatments (P>0.05).

In the present study, production of grass carp with different levels of food (with base of body weight) clearly showed that greatest result obtained in T1 (feeding with 10 percent of body weight) because it had better food conversion ratio (FCR) than other treatments however in growth performance it was lower than the other and T6 showed maximum growth performance with high percentage of food conversion ratio (FCR). According to Erondu *et al*. [26]; Sheunn *et al*. [27], fish feed consist of 60% production cost is to be the most expensive in terms of overall feed cost and reported the best level of feeding rate is essential for culture. This finding agrees with our results. Grayton and Beamish [29] also reported increase levels of food have been caused to increase growth performance. This finding disagrees with our result. However limited data and study exist for performance of feeding with base of different percent of body weight, but finding the optimum percentage of feeding is necessary for improving aquaculture and reduce costs, especially for grass carp that more time being fed.

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