Effects of feeding frequency on common carp (*Cyprinuscarpio L.)* growth rate

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Abstract

In present study the effect of feeding frequency on growth performance, food efficiency and survival rate of common carp fingerlings were investigated. Three groups of common carp fingerlings (average weight 22.88±1 gm) designed with three feeding frequencies one meal a day (D1), two meals a day (D2) and three meals a day (D3) with three replicates of each treatment. Fish in experimental treatments were fed by 4% of body weight. Feeding frequencies had significant effect on growth performance ($P<0.05$). The final body weight and specific growth rate (SGR) were significantly higher in group D3 ($P<0.05$) in this comparison. Similar responses were observed for body weight increased (BWI) and daily growth rate (DGR) and the best BWI and DGR were obtained in D3 group, that showed significantly different to other groups ($P<0.05$). The best feed conversion ratio (FCR) was obtained from three daily feeding (D3), however there were no significant different between D2 and D3 ($P>0.05$). Also feeding frequencies had positive effect on fish survival rate ($P<0.05$). The best results in growth performance and survival rate were obtained by feeding threemeals a day (D3).

Keywords: Feeding Frequency, Growth Performance, Common Carp
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تأثير عدد مرات التعليف في أداء نمو أسماك الكارب العادى

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الخلاصة

أجريت هذه الدراسة في مختبرات فرع الاسماك قسم العلوم الحيوانية، كلية العلوم الزراعية في جامعة السليمانية، حيث استخدمت ٤٥ سمكة بمعدل وزن ٢٢,٨ غرام وتوزعت على ثلاث احواض زجاجية بحيث كل حوض ثلاث مكررات لكل حوض ١٥، غُذيت الاسماك على خلطة علفية متماثلة وقدم العلف لأسماك الحوض الاول مرة واحدة في اليوم،ومرتين لأسماك الحوض الثاني، وثلاث مرات لأسماك الحوض الثالث، أظهرت النتائج ان الحوض التى قدم ثلاث مرات في اليوم كان افضل من الحوض الاول والثاني في اداء النمو ومن هذه تجربة أظهرت كلما زادت عدد مرات تعليف زادت مؤشرات النمو أسماك الكارب الاعتيادى.

Introduction

Nutritional requirements of fish for growth, reproduction and normal physiology are similar to the requirements of other domesticated animals. However, fish mainly differ from other animals in their demand for proteins, so usually fed with 25 to 45% of row proteins are used (1). In this aspect, the efficiency and utilization of proteins are more important in fish.

Feeding presents the largest part of expenses in intensive and semi-intensive aquaculture, so fish food must be of good quality to assure high utilization, high growth rate, and good health. Fish food is formulated to fulfill the requirements of fish with nutrients and energy. Since the food covers 40 to 60% of the total expenses in production (2, 3).

The aim of this paper was to study the effect of feeding frequency on some growth performance parameters in common carp fingerlings.

Materials and methods

The experiment was conducted for 65 days using 45 common carp *Cyprinus carpio* L. which was brought from a local pond located in Qaladzya. Forty five common carp fingerlings with average weight of (D1:22.88gm, D2:21.08gm, D3:21.32gm) were distributed evenly among nine Aquarium. These were static systems cleaned by daily suction, where approximately 10% of the water in the tanks was replaced daily. We used three feed frequencies which was representing three treatments, treatment number one (D1) consist of one time feeding only which the whole feed was given to the fish, treatment number two (D2) consist of two time feeding daily which the feed was divided in to two parts, treatment number three (D3) consist of three time feeding and the whole feed was divided into three parts.

Table 1 represent the chemical composition of experimental diet (BESLER YEM) SANAYI TICARET LTD. STI.

This experiment was carried out in the fish laboratory of the College of Agricultural Sciences, Department of Animal production, Fisheries Branch, University of Sulaimani in Bakrajo. The number of aquarium in the trial was three representing three treatments. Each aquarium with three partitions, each one represents a different treatment and replicate.

Body weight gain

Body weight gain (g/fish) = Mean of weight (g) at the end of the experimental period – weight (g) at the beginning of the experimental period.

Daily weight gain

Daily weight gain (DWG) = Gain / experimental period.

Specific Growth Rate (SGR) (4)

$$SGR = \frac{(Ln\ Wf - Ln\ Wi)}{Time\ (days)} \times 100$$

Wf = final average weight at the end of the experiment, Wi = initial average weight at the beginning of the experiment, Loge = Natural Logarithm reading, Time = Number of days for the experiment.

Relative Growth Rate (RGR) (5)

$$RGR\ (\%) = \frac{(Wf - Wi)}{Wi} \times 100$$

Wf = final average weight at the end of the experiment, Wi = initial average weight at the beginning of the experiment.

Feed Conversion Ratio (g) (FCR) (4)

$$FCR = \frac{Weight\ of\ feed\ given\ (g)}{Fish\ weight\ gain}$$

Table 1: The chemical composition of experimental diet (BESLER YEM) SANAYI TICARET LTD.STI

Composition	Ratio %
Dry matter	(%min) 88
Crude Protein	(%min-max) 28-35%
Crude Fat	(%min-max) 2.5-3%
Crude Fiber	(%max) 18%
Crude Ash	(%max) 10%
Moisture	(%max) 10%
Calcium	(%min-max) 1.0-3.0%
Phosphorus	(%min) 1
NaCl	(%max) 1
Metabolizable Energy	2400 (Kcal/Kg.min)
Vitamin A (Per KG)	5000 IU
Vitamin D3 (Per KG)	700 IU
Vitamin E (Per KG)	30 mg

Analysis of variance was conducted using the general linear models (GLM) procedure of XLSTAT. Pro. 7.5 One way CRD (ANOVA). Fisher's L.S.D test's was used to compare between means of the experiment treatments.

Results and discussion

In the present study, common carp fingerlings had different daily feeding frequencies at three feeding rates. Table 2 shows the growth performance in all different groups at the end of feeding trial. The results clearly showed that increasing the feeding frequency during the time had beneficial effects on the growth parameters on common carp. The maximum of final weight gain was observed in D3 (36.31±1.81) and the lowest of final weight gain was observed in D1 (29.94 ± 3.2).

The specific growth rate (SGR) was improved significantly (P<0.05) with increasing the feeding frequency. The growth data clearly indicated that SGR values of groupD3 (0.65 ± 0.03) was significantly higher

than those of other groups (P<0.05) and lowest SGR was observed in D1 (0.28±0.02).

Table 2: Growth parameters and survival rate of common carp in experimental treatments

Treatment	D1	D2	D3
Initial weight (gm)	22.88 ± 3.4	21.08 ± 2.1	21.32 ± 3.4
Final body weight (gm)	29.94 ± 3.2 b	31.59 ± 2.1b	36.31±1.81a
Body weight Gain (gm)	7.06 ± 0.6c	10.51 ± 0.17b	14.99 ± 1.03a
Daily Growth Rate (DGR)	0.17±0.05c	0.25±0.04b	0.39±0.08a
Specific growth (% /d)	0.28±0.02c	0.42 ± 0.05b	0.65 ± 0.03a
Relative growth (%)	31.71± 2.02c	49.94 ± 1.34b	70.37 ± 1.22a
Survival rate (%)	90.81±5.71a	92.12 ± 4.28a	94.18±2.18a

*means with different superscripts are significantly different (P<0.05).

A significant difference was found in daily growth rate (DGR) among common carp received three meals in a day (D3) with other two groups (D1 and D2). The maximum of DGR was observed in D3 (0.39±0.08) that had significantly different to other groups (P<0.05), followed by D2 (0.25±0.04) and the lowest of DGR was observed in one meal a day (D1) (0.17±0.05) that had significantly different to other treatments (P<0.05). The growth parameters were significantly affected by frequency during the time (P<0.05). In addition, the food conversion efficiency (FCE) by increase feeding frequency was significantly decreased in comparison to those of other groups (P<0.05) and the lowest FCE was observed in D3 (46 ±1.45) followed by D2 (60 ±1.0) and had significantly different (P<0.05) to other groups. The highest FCE was observed in one meal a day (87 ± 2.65) as shown in table (3).

Table 3: Feed Utilization of common carp (*Cyprians carpio*) in experimental treatments

Treatment	D1	D2	D3
Feed Conversion Ratio	1.28 ± 0.0c	1.67±0.0b	2.19±0.0a
Feed Conversion efficiency (%)	87 ± 2.65a	60 ±1.0b	46 ±1.45 b

*means with different superscripts are significantly different (P<0.05).

Survival rate showed no significant differences among treatments and feeding frequency had positive effect on survival rate. The maximum of survival rate obtained on treatment D2 (92.12±4.28) and D3 (94.18±2.18) however, these treatments had no significant differences among each other but three meal a day (D3) showed better survival rate than two meal a day (D2). The lowest survival rate observed in one meal a day (D1) (90.81 ±5.71) and had significantly different to other treatments (P<0.05). Goldan and Karplus (6) and Ayd and Kolotoglu (7) they reported feeding frequencies did not significantly affect in survival rates on sea bream (*Sparusaurata)* and juvenile black sea turbot (*Psetta maxima*), these results with our founding.

Studies conducted on other fish species have shown that feed consumption and growth generally increased with feeding frequency up to a given limit Bascinar (8). This is in agreement with our findings. In present study treatments of grass carp were fed with three meals per day (D3) were better than two (D2) and one meals per day (D1), to similar research Grayton and Beamish (9), who fed rainbow trout fry, three meals a day were better than one or two, also Andrews and Page (10) reported that the channel catfish *Ictalurus punctatus* grew more slowly when fed to satiation once per day than when fed 2 or 4 times. This study demonstrated a significant effect of feeding frequency on growth and food conversation ratio in juvenile common carp. The highest weight gain was obtained (P<0.05) by feeding the fish frequently three times a day. It is evident that a higher growth rate depends on both higher and more frequent daily feed supply.

In the study of Dediu et al. (11) found that rainbow trout fed twice a day performed betterthan those fed four times a day, in terms of SGR, DGR FCR and PER. Ganzon-Naret, (12) demonstrated that feeding frequency (once, two, four and sixtimes daily) significantly improved the growth performance and feed utilization of Asiansea bass. The effects of feeding frequency may vary with the different species, size, and age of fish, dietary protein, energy levels and feeding time as well as the environmental factors (13).

Murai et al. (14) indicated the growth performance of carp fed the starch diet was higher than that fed the glucose diet when the feeding frequency was 2 meals day, but the growth performance of carp was not affected by different dietary carbohydrate sources such as glucose, maltose, dextrin and starch when the feeding frequency was 6 meals day. This is in accordance with Furuichi and Yone (15),

who detected that increasing the feeding frequency could decrease the overloading of metabolic capacity of glucose in carp. Lin *et al*. (16) indicated one of the major reasons of the lower performances in the 2 meals day feeding than the continuous feeding is the habit sturgeon (eat very small in each meal and eat very slowly). Another reason of the lower performance in the 2 meals day feeding than the continuous feeding may have resulted from the overloading of metabolic capacity in the glucose fed sturgeon and digestibility capacity in the starch fed sturgeon. The overloading led to lower lipogenesis by the lower body lipid content in the 2 meals day-1 feeding than the continuous feeding sturgeon as shown in Lin *et al*. (16).

The experiment of Tian et al. (17) showed that under conditions of restricted feeding rate, feeding frequency had a significant effect on weight gain, feed efficiency, protein efficiency ratio and lipid content of the fish. Therefore, based on the results, it suggested that 6 meals day-1 feeding was sufficient for the optimal growth and feed efficiency for grass carp on 35.1-37.5 g.

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