

OBSERVATION ON THE GROWTH PERFORMANCE OF GOLDFISH (*Carassius auratus*) REARED IN AQUARIUMS WITH DIFFERENT LEVELS OF VITAMIN C

Aurelia Nica^{1*}, I. Vasilean¹, Adina Popescu¹

¹University „Dunărea de Jos” of Galați, Romania

Abstract

A 30 days experiment was conducted from 10 June to 10 July, 2015 into aquariums to evaluate the growth performance of goldfish (*Carassius auratus*) with different levels of vitamin C supplementation in diets. The size of experimental aquarium was 55 cm x 25 cm x 35 cm. There were three variants named Control (without vit. C), variant V1 (900 mg vit. C per kg feed) and variant V2 (1800 mg vit. C per kg feed). Each of the variants ran in duplicate. Feeding frequency in all variants was 3 times a day. For each variant 30 exemplars of 3 month age with initial weight of 0, 97 g were stocked. Within the experimental period, the fish were fed at the rate at 10% of their body weight and decreased progressively with increasing body weight. The effects of feeding through vitamin C in different proportions on the parameters such as growth in view of live weight, survival rate, feed conversion, specific growth rate, protein efficacy for the *Carassius auratus* were studied. Results revealed that the growth and dietary utilisation were observed to be greater in variant V1 which contained 900 mg vit C per kg diet followed by V2 variant which contained 1800 mg vit C per kg diet describing clearly the role of a C vit in the diet for growth and feed utilisation. Lowest growth and dietary utilisation was observed in Control variant.

Key words: *Carassius auratus*, vitamin C, growth, aquariums

INTRODUCTION

Ornamental fishes are popular pets around the world and their cultivation can be quite lucrative. Fresh water ornamental fishes are found in different areas in the world and the aquarium industry has developed methods for cultivation and propagation of many common species [3].

The Japanese fish, *C. auratus*, also known as goldfish, is one of the most popular ornamental species in the world due to its varieties with attractive body shape and skin color [4]. Nutrients like fatty acids, amino acids, minerals and vitamins have clear effects on growth as well as reproduction in fish. Vitamin C is an indispensable nutrient required for growth, immune response and maintenance of the physiological process in different animals including fishes [5].

Vitamin C plays an important role in maintaining immune response and is required for numerous biological functions in fish and

other vertebrates, for example, maintaining skeletal integrity, growth and survival and physiologic coefficient such as resistance against stresses, poisoning and immune activities improve in different species of aquatic larvae with usage of vitamin C complements [3].

MATERIAL AND METHODS

Two hundred and seventy healthy and active 90-day-old juveniles of *Carassius auratus*, with initial average weight of 0,97 g, from the same breeders, were divided into three groups, corresponding to three levels of vitamin C, i.e., 0 (control), 800 and 1800 mg/kg diet, which were fixed in a pilot study (fig. 1).

Each diet was tested in duplicate groups consisting of 30 individuals, reared in aquariums (55 cm x 25 cm x 35 cm) containing 48 l static water. Gentle aeration was provided by air stones.

The tanks were drained twice a week and replenished with fresh water to remove accumulated feces from the bottom.

During the experiment, the water quality parameters were monitored during the trial

*Corresponding author: anica@ugal.ro

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and the value for temperature, dissolved oxygen and hydrogen ion concentration (pH)

and were maintained in tolerable limits for goldfish.



Figure 1. The experimental aquariums

We used a commercial diet without vit. C in Control variant, which was supplemented with 900 and 1800 mg vitamin C/kg in other variants (variant 2 and 3 respectively). In all variants the fish were fed with Tetra Discus pellets (Italy). The pellets contain fish meal, oils, cereal and cereal by-products, antioxidants (BHT). Nutrient compositions of experimental diet are given in Table 1.

Table 1 Biochemical composition of pellets

Biochemical composition	UM	V1 (Nutra 4)
Crude protein	%	47.5
Crude oils and fats	%	6,5
Crude fibre	%	2
Moisture content	%	6
A vitamin	U.I./kg	29770
D3 vitamin	U.I./kg	1860

For the preparation of vitamin C containing diet, vitamin C tablets were collected from the local market and weighed. Weight of each tablet was 0.6 g and each tablet contains 180 mg vit. C. Then vit. C was grinded and mixed with feed. Diets were prepared every fortnight and stored in a refrigerator to minimize nutrient loss.

Fish were fed 3 times daily at 8.00 am, 12.30 pm and 5.00 pm. After initial sampling, the fishes were fed at the rate of 10% of their body weight and then at fifteen days decreased to 5% with increasing body weight.

The experiment was conducted for 30 days with goldfish. All fish from each replicate were weighed at the beginning, at two weeks and at the end of the experiment. The total biomass per aquarium was weighed and divided by the number of fish. For this purpose, we used analytical balance Kern EG 220-3 NM.

For evaluating the dietary performances, the following nutritional indices were used:

Weight Gain (W) = Final Weight (W_t) – Initial Weight (W_0) (g)

Feed Conversion Ratio (FCR) = Total feed (F) / Total weight gain (W) (g/g)

Specific Growth Rate (SGR) = $100 \times (\ln W_t - \ln W_0) / t$ (%BW/d)

Protein Efficacy Rate (PER) = $W / F * P_b$, where:

P_b = rough protein of feed (%).

RESULTS AND DISCUSSIONS

The present study shows that dietary supplementation of vitamin C influenced the feeding and growth parameters in *Carassius auratus*. Fish growth and survival are primary key factors for successful development of aquaculture practices.

The growth is one of the important criteria for brood stock development, and

market price of fish is related to growth. Technological performance plays an important role for increasing operating system of fish; it depends on many factors including meeting the nutritional requirements of cultured species and maximizing feeding efficiency, the optimization of feed conversion ratio.

Most teleosts are unable to synthesize ascorbic acid due to the lack of L-gulonolactone oxidase which is necessary to convert L-gulonolactic acid to acid ascorbic; therefore, an exogenous source of vitamin C is required in fish diet [2].

The quantitative requirements on vitamin C have been determined for several species

and the recommended values varied by various studies. James R. and J. Vasudhevan were studied for a period of 120 days the effect of different levels of dietary vitamin C (0, 50, 100, 200 and 300 mg kg diet-1) on the growth, gonad weight, fecundity and leucocyte counts in goldfish and found that 200 mg vit. C. / kg feed can be considered as optimal for growth, reproduction and immune response in goldfish [1]. In the present paper, we had study the effect of 900 and 1800 mg vit C/kg feed on growth in the goldfish, *Carassius auratus*. For our experiment, the growth indicators' of the experimental fish is summarized in Table 2.

Table 2 Technological indicators of growth

Parameter/Variant	Control		V1		V2	
	B1	B2	B1	B2	B1	B2
Initial total biomass (g)	30.34	27.31	29.76	28.75	30.52	27.02
Final total biomass (g)	79.7	75.45	76.32	85.1	70.57	69.7
Initial no. exp.	30	30	30	30	30	30
Final no. exp.	30	30	30	30	30	30
Initial mean body weight (g)	1.01	0.91	0.99	0.96	1.02	0.9
Final mean body weight (g)	2.66	2.52	2.54	2.84	2.35	2.32
Total increase growth (g)	49.36	48.13	46.56	56.34	40.04	42.67
Individual spore growth (g)	1.65	1.60	1.55	1.88	1.33	1.42
FCR	2.3	2.6	2.81	2.5	2.7	2.85
SGR (%/day)	3.2	3.4	3.13	3.63	2.8	3.1
Protein Efficacy Rate	0.6	0.8	0.74	0.92	0.77	0.74

Growth Performance: Out of growth performance parameters for trial groups of goldfish, the best weight growth as of the completion of the experimental period was attained in V1 variant, where the level of vitamin C was 900 mg/kg diet. These variant was followed by Control and V2 variants, respectively (Table 2).

Feed Conversion Rate: When the rates of feed assessment calculated through the amount of feed consumed and live weight, the best feed assessment rates are observed in V1 variant, where the level of vitamin C was 900 mg/kg diet (Table 2).

Specific growth rate: The highest specific growth rate was recorded V1, the percentage rise in the daily growth rate compared with the increase in the 3.63 % / day, whereas for the other variants were 3.2% / day (V2) and 3.1% / day (Control).

Protein Efficacy Rate: When the protein efficacy rate is examined in general terms as of the date of completion of the tests, the highest protein efficacy was observed in V1 variant, where the concentration of vitamin C was 900 mg/kg diet. This is variant was followed by V2 and Control variants (Table 2).

CONCLUSIONS

1. Diets with adequate levels of vitamin C may result in better performance of fish.

2. Fish fed with 900 mg vitamin C kg diet-1 exhibited higher feeding and growth parameters than those fed with other vitamin C diets.

3. Excess Vitamin C in fish diet may be wasteful and cause the diets to be unnecessarily expensive.

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