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Role of L-Arginine and L-Valine in Common Carp Nutrition

N. JEYARAJ AND M. R. RAJAN

Department of Biology, Gandhigram Rural University
Gandhigram 624302 Tamil Nadu, India
E-mail : mrrrajan1961@yahoo.co.in

Abstract

The study deals with the role of L-arginine and L-valine in common carp nutrition for a period of 30 days. Five different feeds having different concentrations of amino acids such as control, feed I (0.3% L-arginine), feed II (0.3% L-valine), feed IIII (0.3% L-arginine and 0.3% L-valine) and feed IV (0.6% L-arginine and 0.6% L-valine) were prepared by using fish meal, ground nut oil cake, wheat flour and tapioca flour. Feed utilization parameters such as feed consumption, feed conversion ratio, feed conversion efficiency, protein consumption, protein efficiency ratio, growth, percentage growth, relative growth rate, assimilation, metabolism, gross growth efficiency and net growth efficiency of common carp were calculated. Feed consumption and protein consumption were higher in feed III containing 0.3% of L-arginine and 0.3% of L-valine. The feed conversion ratio was best in feed III. The growth, percentage growth and relative growth rate were higher in feed IV. Assimilation and metabolism was higher in feed II. The gross growth efficiency was higher in feed IV and net growth efficiency was higher in feed I.
Key words : L-Arginine, L-Valine, Common carp, Nutrition.

A long term goal of aquaculture research is the development of artificial feeds for use in artificial environment. There are about a few criteria with regard to supplementary feed. First the feed must have proper combination of nutrients such as protein, carbohydrate, lipids, minerals, vitamins not only meet the basal energy required for the maintenance but also growth. To increase the digestibility the feed should also contain important amino acids like cystine, arginine and valine. Already a number of investigation have been carried out on the incorporation of cheap and easily available feed ingredients in fish feed for enhancing the growth of fish (1—5). The work related to the incorporation of amino acids L-arginine and L-valine in the feed for common carp nutrition, growth and feed utilization has not been made. In view of the paucity of information, this study was conducted to assess the role of L-arginine and L-valine in common carp nutrition.

Methods

For the present work *Cyprinus carpio* var *communis* fingerlings (0.510 ± 0.01 g) were collected from Pandian fish farm near Dindigul, Tamil Nadu, India and transported to the laboratory in polythene bags filled with oxygenated water. Fish were acclimated in plastic round troughs (60 cm dia) for 15 days at 28 ± 2 C. During acclimation, fish were fed with trainee feed containing fish meal, ground nut oil cake, wheat flour and rice bran in the form of dry pellets. The raw materials used were fish meal, ground nut oil cake, wheat flour, tapioca powder, sunflower oil, Na, Cl, supplevite mix and sodium benzoate. Different ingredients used in the feed preparation were tested for its protein content by micro-Kjeldhal method (6). After knowing their protein contents, feeds were prepared according to square method with a protein level of 40% (7) with various concentrations of L-arginine and L-valine, (Feed-I 0.3% L-arginine, Feed-II 0.3% L-valine, Feed-III 0.3% L-arginine + 0.3% L-valine and Feed-IV 0.6% L-arginine + 0.6% L-valine (Table 1). The components used for feed preparation were dried, powdered and sieved through 425 micron sieve. The ingredients were weighed and mixed thoroughly with 130—150 ml of distilled water. The mixed stuff was put in autoclave for 15 min at 100 C. Then it was extruded with the help of pellectizer. The pellets were dried in room temperature. These pellets were tested for its stability by placing it in the water for one hour.

Uniform size of *Cyprinus carpio* var *communis*

Table 1. Ingredients used in control and experimental feeds (wt in g).

Ingredients	Control	Feed I	Feed II	Feed III	Feed IV
Fish meal	34.15	34.15	34.15	34.15	34.15
Groundnut oil cake	34.15	34.15	34.15	34.15	34.15
Wheat flour	10.85	10.85	10.85	10.85	10.85
Tapioca	10.85	10.85	10.85	10.85	10.85
Fish oil	2	2	2	2	2
Sunflower oil	2	2	2	2	2
Supplevite-mix	4	4	4	4	4
Sodium chloride	1	1	1	1	1
Sodium benzoate	1	1	1	1	1
L-valine	–	–	0.3	0.3	0.6
L-arginine	–	0.3	–	0.3	0.6

(0.510 ± 0.79 mg) fingerlings were selected. The length and weight of fish were taken. Then the fish were introduced in the rectangular through (45 cm × 30 cm × 15 cm). The water was maintained at 10 liters; 10 fingerlings were distributed to each through. For each treatment triplicates were maintained. During rearing the fish were fed on ad-libitum on prepared feed twice a day for one hour each from 0800—0900 h and 0400—0500 h. The unfed was dried to constant weight. The fecal matter was collected daily before changing the water with least disturbance to the fish and dried at 95 C. Approximately 70% of water in the through was replaced with tap water. The experiment was continued for 30 days and on the final day the fish were weighed in live condition. The condition factor (K) was calculated following. Weatherly and Gill (8) for individual fish before and after the experiments. The feed utilization parameters were calculated.

Results and Discussion

Condition factor (K) of *Cyprinus carpio* var *communis* were estimated only for comparative purposes to assess the feed. The condition factor increased in all the fish after rearing for a period of 30 days in different level of amino acids. The condition factor was best in feed I (2.051) containing 0.3% of L-arginine when compared to other feeds. Similar results were reported (9) in common carp reared in 0.3% of L-methionine (Table 2).

The feed utilization parameters are presented in Table 3. Feed consumption of *Cyprinus carpio* was higher in feed 1 containing 0.3% L-valine. In feed IV the feed consumption was decreased. Jones (10) reported that the feed consumption of salmon was higher when the amino acid level in the feed was 0.5 and 2%. The feed consumption significantly varied in feed I and II when compared to control. Feed conversion efficiency was lower in all the feeds. Similar low feed conversion efficiency was reported in mrigal fed with L-methionine and L-lysine (11). Feed conversion ratio was best in feed III containing 0.3% of L-arginine and 0.3% of L-lysine. Ramnarine (12) reported that feed conversion ratio was best (2.0) in catfish *Haplosternum littorale* fed with L-arginine and L-valine. Protein consumption of *C. carpio* was higher (80.61) in feed III containing 0.3% of L-valine. But the protein efficiency ratio was 0.18 in catfish *Clarias gariepinus* fed with 5 g of amino acid per kg of feed. Growth and percentage growth were increased in feed IV containing 0.6% of L-arginine and 0.6% of L-valine. The growth was significantly varied in feed I, II and III. The growth in fed IV did not vary significantly. Like growth, the relative growth rate of *C. carpio* was higher (0.117) in feed IV. Similar result was reported when mrigal and common carp fed with L-methionine and L-lysine in the feed (13, 14). In the present study both assimilation and metabolism of *C. carpio* was higher in feed II containing 0.3% of L-lysine. Similar result was reported in mrigal fed with L-lysine at concentration of 0.3% (14). The gross growth efficiency was higher in feed IV containing higher quantity of L-arginine and L-valine (0.6%) when compared to other feeds. The gross growth efficiency significantly varied in different feeds. The net growth efficiency was higher in feed I containing L-arginine. The present study indicates that L-arginine is needed in the feed for higher net growth efficiency of the fish. The net growth significantly varied in different feeds compared to control. From the

Table 2. Condition factor (K) of common carp grown in control and in different feeds.

Feed	Initial	Final
Control	1.422 ± 0.8972	1.878 ± 1.148
Feed I	1.741 ± 1.0582	2.051 ± 1.173
Feed II	1.620 ± 1.0035	1.891 ± 1.121
Feed III	1.588 ± 0.8708	1.757 ± 1.067
Feed IV	1.610 ± 0.8825	2.014 ± 1.162

Table 3. Feed utilization parameters of common carp (*Cyprinus carpio* var *communis*) in relation to different feeds (with different amino acid concentrations). Each value is the average (± SD) performance of 10 individuals in triplicate observed for 30 days. S—Significant at 0.05, NS—Not significant.

Parameters	Control	Feed I	Feed II	Feed III	Feed IV
Feed consumption (FC) g/g live wt 30 days	1.680 ± 1.023a	1.659 ± 1.01b	2.061 ± 1.046c	2.182 ± 1.21d	2.050 ± 1.17e
Feed conversion Efficiency (FCE)	0.010 ± 0.005	0.011 ± 0.006	0.010 ± 0.006	0.008 ± 0.00	0.012 ± 0.00
Feed conversion ratio (FCR)	8.120 ± 4.212	7.012 ± 2.52	7.247 ± 3.772	10.231 ± 5.4	8.024 ± 4.11
Protein consumption (PC) g/g live wt 30 days	60.54 ± 20.526	60.675 ± 30.75	71.83 ± 36.07	80.61 ± 41.0	71.33 ± 36.0
Protein efficiency ratio (PER)	0.024 ± 0.010	0.037 ± 0.016	0.054 ± 0.026	0.028 ± 0.01	0.033 ± 0.01
Growth (G) g/g live wt 30 days	0.101 ± 0.100a	0.110 ± 0.116b	0.140 ± 0.133c	0.103 ± 0.11d	0.152 ± 0.14e
Percentage growth (PG) (%)	24.280 ± 10.2	30.085 ± 12.1	28.256 ± 11.6	18.206 ± 15	30.17 ± 12.7
Relative growth rate (RGR)	0.088 ± 0.04	0.110 ± 0.052	0.114 ± 0.061	0.012 ± 0.04	0.117 ± 0.062
Assimilation (A)	0.316 ± 0.12	0.33 ± 0.143	0.704 ± 0.353	0.553 ± 0.27	0.625 ± 0.313
Metabolism (M)	0.118 ± 0.12	0.120 ± 0.116	0.444 ± 0.210	0.350 ± 0.15	0.362 ± 0.162
Gross growth efficiency (GGE)	10.08 ± 5.30a	11.37 ± 6.188b	11.104 ± 5.88c	8.006 ± 4.10d	11.65 ± 6.256e
Net growth Efficiency (NGE %)	38.17 ± 27.2a	46.326 ± 33.1b	20.60 ±10.20c	24.25 ± 10.3d	27.114 ± 11.0e

Feed consumption		Growth	
a vs b	S	a vs b	S
a vs c	S	a vs c	S
a vs d	NS	a vs d	S
a vs e	NS	a vs e	Ns

Gross growth efficiency		Net growth efficiency	
a vs b	S	a vs b	S
a vs c	S	a vs c	S
a vs d	S	a vs d	S
a vs e	S	a vs e	S

results it is inferred that 0.6% of arginine and 0.6% of valine are needed for the feed consumption, growth, relative growth rate and gross growth efficiency of common carp.

References

1. Mathavan M. and M. S. M. Christopher. 1980. Studies on feed utilization in *Macropodus cupanus.*Aquacul. 6 : 23—29.
2. Viola S., S. Mokady and Y. Arieli. 1983. Effect of soybean processing methods and growth of carp (*Cyprinus carpio*) Aquacul. 39 : 7—38.
3. Wee K. L. and L. T. Ng. 1986. Use of cassava as energy source as a pellected food for the tilapia *Oreochromis nilotica* L. Aquacul. Fish Manag. 17 : 124—138.
4. Siva S. S. D. and R. M. Gunasekara. 1989. Effect of dietary protein level and amount of plant ingredient (*Phaseolus aureus*) incorporated into the diets on consumption, growth performance and carcass composition in *Oreochromis niloticus* (L.) fry. Aquacul. 80 : 121—133.
5. Daniel T. and A. Sahayaraj. 1980. Evaluation of *Leucaena leucocephalia* seed kernel as protein supplement of Sarotherodon mossambica. The Indian Zoolog. 14 : 155—157.
6. Jeyaraman J. 1992. Laboratory manual in biochemistry. Wiley Eastern Ltd., New Delhi, India.
7. Ali S. A. 1980. Feed formulation method : Manual of research methods for fish and shell fish nutrition. CMFRI Spl. Publ. No. 8. pp. 98.
8. Weatherly A. H. and H. S. Gill. 1987. The biology of fish growth. Academic Press. London, UK.
9. Rajan M. R. and S. Santha Sheela. 2005. Role of crystalline L-methionine and L-lysine on growth and feed utilization of common carp. J. Ext. and Res. 7 : 5—6.
10. Jones E. H. 1972. Fish nutrition. Academic press, New York, USA.
11. Rajan M. R. and M. Shyamala. 2005. Role of L-methionine and L-lysine in mrigal nutrition. Environ. and Ecol. 24 S : 20—22.
12. Ramnarine I. W. 1995. The effects of varying protein

levels on growth, feed conversion, protein retention and body composition in the armoured catfish *Haplosternum littorale.* J. Aqua. Tropics 10 : 159—165.

13. Qyedapo A. F. 1999. Comparative evaluation of heat processed winged bean *Psophocarpus tetragonolobus* meals as partial replacement for fish meal diets for the African catfish. Aquacul. 170 : 297—305.

14. Murai T., W. Daozum and H. Ogata. 1989. Supplementation of methionine to soy flour diets for fingerling *Cyprinus carpio.* Aquacul. 17 : 373—385.