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Effect of inclusion of garlic (*Allium sativum*) on feed utilization and growth in Amur carp, *Cyprinus carpio haematopterus*

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Abstract
An eight months growth study was carried out to investigate the supplemental effects of dietary garlic (*Allium sativum*) powder on growth, feed utilization and whole body composition of fingerlings of amur carp (C*yprinus carpio haematopterus).* Fingerlings with an average weight of 16.11± 0.86g were distributed into four treatment groups T_1, T_2, $T_3$and T_4 (25 fishes randomly distributed in each of 12 tanks. The water quality parameters viz. water temperature, pH, dissolved oxygen, free carbon dioxide and total alkalinity were regularly monitored. Experimental diets were prepared by mixing rice bran, deoiled mustard cake, deoiled soybean cake and vitamin-mineral mixture. The garlic powder (GP) was incorporated in to diets at the rate of 0.5% (GP 0.5), 1.0% (GP1.0) and 1.5% (GP1.5). GP was not added to the control diet (GP0). The experimental feed diets were isoproteinous and contained 28.0% protein and 7.5% lipid on dry matter basis. The experimental fishes were fed @ 5% of their body weight daily. After the feeding trial, weight gain (WG) of fish fed with GP0.5, GP1.0 and GP1.5 was significantly higher (p<0.05) than those of fish fed with GP 0. Net weight gain (NWG) and specific growth rate (SGR) showed a similar trend as weight gain (WG). Protein efficiency ratio of fish fed with GP0.5, GP1.0 and GP1.5 was also significantly higher (p<0.05) than those of fish fed with the control diet. The values of feed conversion ratio (FCR) and gross conversion efficiency (GCE) did not differ significantly (P>0.05) amongst different treatment groups. The obtained results indicated that T_4 (GP1.5) was the best treatment which realized significant increase in parameters related to growth performance.

Keywords: Dietary garlic, Isoproteinous diets, Protein efficiency ratio, Specific growth rate

Introduction
Fish is highly nutritive and rich source of animal protein. To achieve maximum yield from fresh water resources, it is necessary to provide an artificial feed to fish so that fishes grow rapidly and attain maximum weight in shortest possible time (Bhosale *et al*., 2010) [4]. Aquaculture has been a growing activity for the last twenty years worldwide and this impressive development has led to some practices which are potentially damaging to animal health (Naylor and Burke, 2005) [16]. One approach is to include new substances into fish diets to improve feed conversion efficiency or elevate general conditions for fish growth and maintenance (Fernandez *et al*., 2006) [11]. Plants are natural source of safer and cheaper phytochemicals. Beneficial effects of bioactive plant substances in animal nutrition may include the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune responses, and antibacterial, antiviral and antioxidant actions (Citarasu., 2010) [9]. Plant products have been reported to promote various activities like anti-stress, growth promotion, appetite stimulation and immunostimulation in aquaculture practices (Sivaram *et al*., 2004) [21]. Garlic (*Allium sativum*) is a perennial bulb-forming herb. Garlic has been a subject of considerable interest for centuries as a flavouring agent, traditional medicine and a functional food to enhance physical and mental health. Garlic was studied in different forms of extracts: aqueous, ethanol and dried powder (Shin and Kim., 2004) [20]. It contains a variety of organo-sulfur compounds such as allicin, ajoene, S-allylcysteine, diallyl disulfide and S-methylcysteinesulfoxide (Chi *et al*., 1982) [8]. A wide array of beneficial effects of garlic such as antihypertensive, antihyperlipidemic, antimicrobial, hypoglycaemic, anticancer, antidote (for heavy metal poisoning), anticarcinogenic, hepatoprotective and immunomodulation have been reported by researchers (Augusti, 1996; Bordia *et al*., 1996; Nya and Austin, 2009) [3, 5, 18]. Dietary garlic as a growth promoter in Nile tilapia (*Oreochromis niloticus*) improved body weight gain, feed intake and feed efficiency (Shalaby *et al*., 2006) [19].

Material and methods

Experimental set up: The study was carried at College of Fisheries, Pantnagar located in tarai belt of Shivalik range of Himalaya. The site experiences a humid sub-tropical climate characterized by very hot dry summer and cold winter. The experiment was conducted in circular FRP tanks under indoor conditions. The hatchery reared fingerlings of Amur carp (*Cyprinus carpio haematoptereus*) having average weight of 16.11±0.86 g and length of 9.5±0.5 cm were stocked in tanks (1 ton capacity). Each tank contained 25 fingerlings. The fishes were acclimatized for 7 days before conducting the experiment. The water was aerated every day for 4 hours. The study was conducted for a period of 230 days (June, 2015 to February, 2016) to evaluate the effect of inclusion of garlic powder in feed on feed conversion efficiency and growth of fingerlings of Amur carp. The experimental fishes were subjected to four treatments (T1, T2, T3 and T4) in three replicates (4 x 3 = 12). After stocking, fingerlings were fed with experimental diets. In treatment T1 (control), the fishes were fed with diet without garlic powder (D1). The fishes stocked in treatments T2, T3 and T4 were fed with diets containing 0.5% (D2), 1.0% (D3) and 1.5% (D3) garlic powder, respectively. The feeding was done at the rate of 5% of body weight daily. The water quality parameters viz. water temperature, pH, dissolved oxygen, free carbon dioxide and total alkalinity were regularly monitored as per standard methods (APHA, 2012) [1]. Half of the water of tanks was exchanged on weekly basis.

Preparation of experimental diets: Bulbs of garlic *(A. sativum)* were procured from the vegetable market and initially dried properly under shade for 7 days. Air-dried garlic was again dried at 60^0C for 8 days in oven. After drying, garlic was ground to make powder and kept in dry and cool condition for further use in making fish feed. Four isoproteinous experimental diets were prepared by mixing deoiled mustard cake, deoiled rice bran, soybean meal and vitamin-mineral mixture (Tables 1 and 2). In control diet (D1), garlic powder was not added while 0.5% garlic powder in diet D2, 1.0% garlic powder in diet D3 and 1.5% garlic powder in diet D4 was added.

Estimation of growth and feed conversion: Various parameters pertaining to growth and feed conversion in Amur carp were estimated as follows-Net weight gain (NWG) = Final weight (g) - Initial weight (g)

Weight gain (WG %) = (Final weight –initial weight) / initial weight x 100

Specific growth rate (SGR %): = [log [final weight]-log [initial weight] / t (time interval in days)] x100

Feed conversion ratio (FCR) = Dry weight of feed given in g / wet weight gain in g

Gross conversion efficiency (GCE) = Wet weight gain in g/ dry weight of feed given in g

Protein efficiency ratio (PER) = Gain in body weight of fish (g) / protein intake (g)

Table 1: Composition of experimental feed for *Cyprinus carpio haematopterus*

Sl. No.	Ingredients	% of ingredients
1	Deoiled mustard cake	24.75
2	Soybean meal	24.75
3	Deoiled rice bran	49.5
4	Vitamin-mineral mixture	1.00

Table 2: Proximate composition of experimental feed for *Cyprinus carpio haematopterus*

Sl. No.	Contents	Percentage of content on dry matter basis
1	Crude protein	28.0
2	Crude fat	7.5
3	Ash	7.0
4	Moisture	11.0

Results and discussion

The observations on water quality parameters viz. water temperature, pH, dissolved oxygen, free carbon dioxide and total alkalinity during the study period have been included in Table 3. The ranges of these physico-chemical parameters of water were within the optimum limits for carp rearing, as also reported by other workers (Jhingaran, 1995; Chauhan, 2001, 2014; Nazir *et al*., 2015; Arya *et al*., 2016) [13, 6, 7, 17, 2].

Table 3: Observations on water quality parameters in different treatments (mean ± SE).

Parameters	Treatments			
	T1/D1	T2/D2	T3/D3	T4/D4
Water Temperature (0°C)	22.43±2.61	22.72±2.54	23.16±1.99	22.88±2.59
pH	7.58±0.14	7.51±0.15	7.76±0.11	7.78±0.09
Dissolved oxygen (mg/l)	6.99±0.30	6.91±0.28	7.06±0.28	6.91±0.26
Free CO_2 (mg/l)	2.15±0.06	2.13±0.05	2.14±0.05	2.14±0.06
Total alkalinity (mg/l)	125.43±6.63	123.34±5.93	125.71±6.88	131.57±6.80

T1/D1- Treatment 1 where fingerlings were fed with feed without garlic powder
T2/D2- Treatment 2 where fingerlings were fed with feed containing 0.50% garlic powder
T3/D3- Treatment 3 where fingerlings were fed with feed containing 1.0% garlic powder
T4/D4- Treatment 4 where fingerlings were fed with feed containing 1.50% garlic powder

The details of weight gain (WG), net weight gain (NWG), specific growth rate (SGR), feed conversion ratio (FCR), gross conversion efficiency (GCE) and protein efficiency ratio (PER) have been presented in Table 4. The highest weight gain (195.18±1.30 g) and net weight gain (32.40±0.3899) were recorded in treatment T4/D4in which 1.5% powder of *A. sativum* was added to fish feed. The values of WG and NWG were significantly (P>0.05) higher than T3/D3 (1.0% *A. sativum* incorporation), T2/D2 (0.5% *A. sativum* incorporation) and T1D1 (control – no incorporation of *A. sativum* in fish feed). Megbowon *et al.* (2013) [15] and Guo *et al*. (2012) [12] also found better values of weight gain and net weight gain in fishes fed with garlic added diets.

The SGR and PER in Amur carp after 8 month study varied significantly between control and treatment groups. The highest values of SGR ((0.180±0.009 %/day) and PER (1.160± 0.0113) were recorded in treatment T4/D4 where 1.5% garlic powder was incorporated in fish feed. These values of SGR and PER were significantly (P>0.05) higher than control and other treatments viz. T3/D3, T2/D2 and

T1/D1. The present results find support from the findings of Solomon and Ochume (2013) [22] and Farahi *et al*., (2010) [10] who found higher SGR in *Clarias gariepinus* fed with bitter kola (*Garcinia kola*) seed incorporated diets and in *Oncorhynchus mykiss* reared on garlic added diets than control fishes in both the cases. Better values of PER were also recorded in *Acipenser ruthenus* (Lee *et al*., 2012) [14] and cichlid wefasu (Megbowon *et al*., 2013) [15] raised on garlic (*A. sativum*) supplemented feeds than in control fishes.

The values of FCR varied from 1.530± 00.045 to 1.54± 0.0089 and that of GCE from 0.646±0.0018 to 0.650± 0.0018 (Table 4) in various treatment groups. The FCR and GCE did not differ significantly (P>0.05) among control and treatment groups fed with different percentages of garlic powder.

Table 4: Survival, growth and feed conversion in *Cyprinus carpio haematopterus* fingerlings fed with garlic powder incorporated diets

Parameters	Treatments			
	T1/D1	T2/D2	T3/D3	T4/D4
Fish stocked (No.)	75	75	75	75
Fish harvested	43	51	58	61
Initial weight (g)	16.51±0.05	16.45±0.05	16.5±0.04	16.45±0.04
Final weight (g)	45.00±2.56	48.50±3.99	48.00±2.34	49.00±3.39
Survival (%)	57	68	77	81
Net weight gain (g)	28.50± 0.44	32.00 ±0.44	31.60± 0.26	32.40± 0.38
Weight gain (%)	172.72± 0.93	193.93± 1.95	192.68± 0.96	195.18± 1.30
Specific growth rate (%/day)	0.167±0.0013	0.179 ±0.0018	0.179± 0.0013	0.180±0.0009
Feed conversion ratio	1.540±0.0089	1.530 ±0.0045	1.540±0.0022	1.540 ±0.0045
Gross conversion efficiency	0.649±0.0040	0.650±0.0018	0.646±0.0018	0.647±0.0018
Protein efficiency ratio	1.018± 0.0047	1.142± 0.0085	1.128± 0.0089	1.160± 0.0113

T1/D1- Treatment 1 where fingerlings were fed with feed withoutgarlic powder
T2/D2- Treatment 2 where fingerlings were fed with feed containing 0.50% garlic powder
T3/D3- Treatment 3 where fingerlings were fed with feed containing 1.0% garlic powder
T4/D4- Treatment 4 where fingerlings were fed with feed containing 1.50% garlic powder

Conclusion

It can be concluded from the results of the present investigation that specific growth rate was significantly higher in fish (*Cyprinus carpio haematopterus*) fed with diet containing 1.5% garlic powder. The dried garlic powder can be safely incorporated up to 1.5% in carp feed.

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References

1. American Public Health Association. Standard Methods for the Examination of Water and Wastewater. 22th ed. American Public Health Association, Washington D.C. 2012, 1496.
2. Arya P, Nazir I, Chauhan RS. Evaluation of growth performance in fingerlings of Indian major carp *Labeo rohita* fed with nutraceutical Stimulin incorporated diets. J. Env. Bio-Sci. 2016; 30(1):197-200.
3. Augusti KT. Therapeutic values of onion (*Allium cepa* L.) and garlics (*Allium sativum* L). Indian J. Exp. Biol. 1996; 34:634-640.
4. Bhosale SV, Bhilave MP, Nadaf SB. Formulation of Fish Feed using Ingredients from Plant Sources. Res. J. Agric. Sci. 2010; 1:284-287.
5. Bordia A, Verma SK, Srivastava KC. Effect of garlic on platelet aggregation in humans: A study in healthy subjects and patients with coronary artery disease. Prostoglandin Leukot. Essent. Fatty Acid. 1996; 55:201-205.
6. Chauhan RS. Status of composite culture of carps at three management levels in tarai region of Uttranchal. In: Proceedings of the National Symposium on Fish Health Management and Sustainable Aquaculture, 2001, 11-14.
7. Chauhan RS. Study on growth and survival of giant freshwater prawn, *Macrobrachium rosenbergii,* in tarai agroclimatic regime of Uttarakhand. Ecophysiol. Occup. Hlth. 2014; 14(1-2):103-109.
8. Chi MS, Koh ET, Steward TJ. Effects of garlic on lipid metabolism in rats fed cholesterol or lard. J. Nutr. 1982; 112:241-248.
9. Citarasu T. Herbal biomedicines: A new opportunity for aquaculture industry. Aquacult. Int. 2010; 18:403-414.
10. Farahi A, Kaisri M, Sadagar M, Iraei MS, Shahkolal MD. Effect of garlic *(Allium sativum)* on growth factors, some hematological parameters and body compositions in rainbow trout *(Oncorhynchus mykiss)* AACL Bioflux. 2010; 3(4):317-323.
11. Fernández NM, Peragón J, Esteban F, Higuera M, Lupiáñez JA. Maslinic acid as a feed additive to stimulate growth and hepatic protein-turnover rates in rainbow trout (*Onchorhynchus mykiss*). Comp. Biochem. Physiol. Toxicol. Pharmacol. 2006; 144:130-140.
12. Guo JJ, Kuo CM, Chuang YC, Hong JW, Chou RL, Chen TI. The effects of garlic-supplemented diets on antibacterial activity against *Streptococcus iniae* and on growth in orange-spotted grouper, *Epinephelus coioides*. Aquaculture, 2012; 364-365:33-38.
13. Jhingran VG. Fish and Fisheries of India. Hindustan publishing Corporation, India. 1991, 727.
14. Lee DH, Ra CS, Song YH, Sung KI, Kim JD. Effect of dietary garlic extracts on growth, feed utilization and whole body composition of juvenile sterlet sturgeon (*Acipenser ruthenus*). Asian-Aust J. Anim Sci. 2012; 25:577-583.
15. Megbowon I, Adejonwo OA, Adeyemi YB, Kolade OY, Adetoye AAACA, Edah B *et al.* Effect of garlic on growth performance, nutrient utilization and survival of an ecotype cichlid, 'Wesafu'. Journal of Agriculture and Veterinary Science (IOSR-JAVS). 2013; 6(3):10-13.
16. Naylor R, Burke M. Aquaculture and ocean resources: Raising tigers of the sea. Annu. Rev. Environ. Resour.

2005; 30:185-218.
17. Nazir I, Arya P, Chauhan RS. Evaluation of growth promoting potential of probiotic Biosyn in fingerlings of Indian major carp *Labeo rohita*. Nat. J. Life Sci. 2015; 12(2):173-175.
18. Nya EJ, Austin B. Use of garlic, *Allium sativum*, to control *Aeromonas hydrophila* infection in rainbow trout, *Oncorhynchus mykiss* (Walbaum). J. Fish Dis. 2009; 32:963-970.
19. Shalaby AM, Khattab YA, Rahman AM. Effects of Garlic (*Allium sativum*) and Chloramphenicol on growth performance, physiological parameters and survival of Nile Tilapia (*Oreochromis niloticus*). J. Venom. Anim. Toxins incl. Trop. Dis. 2006; 12(2):172-201.
20. Shin SH, Kim MK. Effect of dried powders or ethanol extracts of garlic flesh and peel on lipid metabolism and antithrombogenic capacity in 16-month-old rats. Hanguk Yongyang Hakhoechi, 2004; 37:515-524.
21. Sivaram V, Babu MM, Immanuel G, Murugadass S, Citarasu T, Marian MP. Growth and immune response of juvenile greasy groupers (*Epinephelus tauvina*) fed with herbal antibacterial active principle supplemented diets against *Vibrio harveyi* infections. Aquaculture, 2004; 237:9-20.
22. Solomon SG, Ochume J. Growth performance and hematological parameters of *Clarias gareipinus* fingerlings fed varied levels of bitter cola *(Garcinia kola* Seed*)* meal. Journal of Fisheries International. 2013; 8(3-6):63-68.