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Research Paper

Use of Probiotics in Fresh Water Aqua Culture

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ABSTRACT

The development of non-antibiotic and environmental friendly agents is one of the key factors for health management in aquaculture. The application of probiotics in aquaculture of india emerged in 1990s; subsequently, commercial probiotic products from USA, Japan and United Kingdom were introduced into India in the late 1990s . Scientists in China and Japan started to screen for new probiotic strains from local aquaculture rearing unit in an attempt to suit the specific requirements of sea food. As products containing probiotic bacteria are gaining popularity in aquaculture It has wide application in production and quality of fresh water fish in India . At present, data about the efficacy of probiotics in fresh water aquaculture of Gangatic plain of India are still lacking.

This Paper discusses mainly the studies and applications about species, effects, mechanisms, problems and prospect of probiotics in popular species of fresh water fish (Rohu)in north India .The effects of a commercial probiotic Endulact, combination of 5 useful bacterial strains, yeast, vitamins and minerals were tested on Labeo rohita (Rohu) .

L.rohita offered the control diet exhibited lower growth and feed utilization than all experimental treatments. There was no effect of probiotic inclusion level on survival but growth was better at all inclusion levels than in the control. No significant differences ($P > 0.05$) in growth were observed among fish groups fed various levels of the probiotic. Carcass composition was not affected by dietary probiotic inclusion

Introduction

Prorobiotics are live microorganisms thought to be beneficial to the host organism and can be defined as "Live microorganisms which when administered in adequate amounts confer a health benefit on the host".Lactic acid bacteria (LAB) and bifidobacteria are the most common types of microbes used as probiotics; but certain yeasts and bacilli may also be helpful. Probiotics are commonly consumed as part of fermented foods with specially added active live cultures; such as in yogurt, soy yogurt, or as dietary supplements.These may be few of the most comman used and known today but probiotics are not limited as direct food suppliment to humans . The use of prebiotics and probiotics as feed supplements that improve efficiency of intestinal bacteria is becoming popular in animal husbandry in many regions worldwide. L.rohita aquaculture is established in various regions around the Gangetic plains of India and has good potential in northern India especially Uttar Pradesh and Bihar. It is a herbivorous fish and can potentially be reared using diets without fishmeal. However, a perceived disadvantage of feed without fishmeal is a reduction in digestibility and assimilation by the fish. Various studies showed that farmed fish performance might be ameliorated by using feed additives such as aromatic plant extracts including spices, digestive enzymes and probiotics. Spice and natural herbs such as marjoram, basil, licorice root, black seed and peppermint have been shown to be beneficial by Abd Elmonem et al. (2002), Sakr (2003), Shalaby et al. (2003) and El-Dakar et al. (2004a,b,c). Another class of feed additives to receive attention in aquaculture recently has been probiotics (live microbes that may improve intestinal microbial balance) (Gatesoupe 1999; Jrianto & Austin 2002). Evidence of the beneficial effects of probiotics gave birth to the concept of prebiotics (Teitelbaum & Walker 2002) which are defined by Gibson & Roberfroid (1995) as _a nondigestible food ingredient which beneficially affects the organism by selectively stimulating the growth of and/or activating the metabolism of one or a limited number of health promoting bacteria in the intestinal tract, thus improving the host's intestinal balance _. Examples of prebiotic use in aquaculture are limited and some information on prebiotic use in general is offered by Szilagyi (2002) and Teitelbaum & Walker (2002).

Materials and methods

Experimental system

Experimental fish were collected from local fishermen at Kanpur and immediately transported in plastic buckets to a rectangular fibre glass tank filled with fresh water . Fish were quarantined for 1 week in the rearingtank, and then sorted by weight removing all large and small individuals. The feeding trial included 15 net cages (100 · 100 · 40 cm; L · W · H) placed in a large fiberglass tank using three replicate cages per treatment. Ten juvenile fish (average weight 10.3 g) were randomly stocked into each experimental cage. During the first 3 days of the experiment, dead fish were replaced with individuals of the same size. Approximately 35% of the water was exchanged daily and aeration was provided using submerged air diffusers and a reciprocating air blower.Temperature, pH, dissolved and oxygen were measured daily and remained at approximately 27 deg C, 7.9, 4 mg /kg , respectively. Ammonia and nitrite nitrogen were measured periodically and remained below 0.2 mg /L due to daily water exchange.

Diet preparation and feeding Experimental diets were prepared on site using locally available ingredients (Table 1). The recipe was designed to contain 30% crude protein and 7.7% lipids. Ingredients were thoroughly mixed then boiling water was added to the mixture.The mash was pelletized using a meat mincer with a 1.5-mm die. Pellets were dried at 40 deg C in an oven and stored at)20 _C. The feed additive used was a commercial natural enhancer mix (NEM) Endulact..Five experimental diets were produced, a

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control and four containing the NEM at 0, 1, 2, 3 and 4 g kg)1. Each diet was offered to three randomly chosen cages at 4% of biomass daily, 6 days a week, for 98 days. Daily ration was divided into three equal portions supplied at 9.00, 12.00 and 15.00 h. All offered feed was consumed by the fish within 20 min. Fish were weighed at 2-week intervals and ration was adjusted according to new fish weight per cage.

Table 1 Ingredients and proximate analysis of experimental diets

	Diet no.				
Ingredients (g kg^{-1})	1	2	3	4	5
Fish meal	100	100	100	100	100
Soybean meal	200	200	200	200	200
Wheat milling by-product	480	479	478	477	476
Wheat bran	50	50	50	50	50
Corn starch	100	100	100	100	100
Endulact	0	1	2	3	4
Sunflower oil	25	25	25	25	25
Fish oil	25	25	25	25	25
Vitamin and mineral premix	20	20	20	20	20
Chemical composition					
Dry matter (g kg^{-1})	931.8	942.8	945.3	944.1	938.5
(g kg^{-1}) DM basis					
Crude protein	307.9	297.9	301.9	307.7	302
Ether extract	90.5	68.7	70.6	79.0	83
Crude fibre	23.5	23.9	21.6	22.5	22.9
Nitrogen free extract	485.7	529.8	520.4	505.9	511.2
Ash	92.4	79.7	85.5	84.9	80.9
Calculated energy value					
GE (kJ g^{-1} diet)	19.40	19.10	19.10	19.31	18.48
DE (kJ g^{-1} diet)	16.68	16.43	16.39	16.60	16.68
P/E ratio (mg CP kJ^{-1} DE)	18.46	18.13	18.43	18.54	18.06

Data of the carcass composition of L.rohita offered diets with various levels of NEM as a natural growth promoter are given in Table 3. Although significant differences in moisture level and crude protein proportion are apparent among treatments, they do not follow a trend and thus suggest that variations among results are probably due to inherent variation associated with using wild undomesticated gene stock in research. However, results suggest a positive correlation between NEM supplementation and lipid concentration of the carcass. Similar results were observed when spices were used in graded levels in fish diets, e.g. black seed and roquette seed by-products (Abd Elmonem et al. 2002); licorice root meal (Shalaby et al. 2003); fennel seed meal (El-Dakar et al.2004c).

Viscera composition was affected by graded levels of NEM supplementation to L.rohita diets. Moisture levels in the viscera decreased with an increase in NEM levels in the diets. On the other hand, viscera fat content did not change as NEM level increased. It is noteworthy to state that viscera of aquacultured fish tend to be very high in lipid compared with viscera of wild fish of the same size and age (I. Saoud, unpublished data). This may be due to the fact that fish is an algaevore in nature while under culture conditions it is offered feed with high protein and lipidcontent. We believe that the fish should be offered a vegetable diet with low levels of oil supplementation.Incidence cost values of fish offered diets with 0, 1, 2, 3 and 4 g kg)1 NEM upplement were 5.81, 4.28, 4.35, 4.66 and 4.96 LE kg)1 gain, respectively.

Table 4 Cost–benefit analysis of fish fed different levels of test natural enhancer mixture

	Diet no.					
Item	1	2	3	4	5	MSE
Cost per kg diet	1.93	1.96	2.00	2.03	2.06	–
Incidence cost[1]	7.4[a]	5.4[b]	5.4[b]	5.7[b]	5.8[b]	0.20
Change in IC	100	73	73	77	78	–
Profit index[2]	1.4[b]	1.9[a]	1.9[a]	1.8[a]	1.7[a]	0.05
Change in PI	100	136	138	129	127	–

Values in the same row with the same superscript are not significantly different ($P > 0.05$). MSE, mean standard error. Cost of fishmeal, soybean meal, wheat milling by-product, wheat bran, corn starch, Biogen®, sunflower oil, fish oil, vitamin and minerals premix per kg were 4.8, 2.2, 1.0, 0.75, 0.7, 35.0, 5.0, 5.0 and 8.5 LE, respectively.

[1] Incidence cost = feed cost consumed to produce 1 kg weight gain fish.

[2] Profit index = value of fish/cost of feed consumed, 1 kg fresh fish equals 10 LE (Egyptian Lira).

These results indicated that dietary NEM supplementation would decrease feed costs by 73%, 73%, 77% and 78% for fish offered diets with 1, 2, 3 and 4 g kg)1 NEM, respectively. Profit index thus improved with NEM supplementation to the basal diet, but level of supplementation did not confer any additional economic benefit. Similar results were observed by El-Haroun et al. (2006)We conclude from the present research that dietary supplements can impart beneficial effects on L.rohita growth and that translates into financial benefits for farmers by decreasing feed cost per unit growth of fish. Probiotics also help in disease resistance of fish (Shelby et al. 2006) and could be beneficial for fish in the present study. Future research will identify the benefits of the various probiotics and prebiotics within the NEM we used, and interactions amongst them. L. rohita an algaevorous when reared with the supplementation of NEM to vegetarian diets may improve digestibility and assimilation, thus making the diets suitable for carp aquaculture. Research into the physiological effects of probiotic and prebiotic use is warranted.

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