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Effect of cellulose rich banana peel powder and fish intestinal cellulolytic microbes on growth and biochemical changes of fish *Etroplus suratensis* (Bloch)

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ABSTRACT

To evaluate the efficiency of different probionts (*Bacillus altitudinis* and *Bacillus licheniformis*) with banana peel powder on *Etroplus suratensis,* three different pelleted diets were formulated with 40% protein and in which two diets were supplemented with probionts such aa 1% *Bacillus altitudinis* +2% Banana peel powder (diet A) and 1% *Bacillus licheniformis*+ Banana peel powder (diet B) and a (diet C) with 2% CMC without probiont was used as control. The water stability of these diets was studied as a function of exposure duration. The leaching percentage during 6 hrs periods did not vary much between experimental diets (9.60% to 16.70%). The specific growth rate of *E.suratensis* revealed that the control diet s fed fishes. The gross production efficiency was also higher in probionts supplemented diet fed groups than control group.

Keywords : Cellulase, *Bacillus altitudinis*, *Bacillus lilcheniformis, Etroplus suratensis*, Banana peel powder.

1 INTRODUCTION

Currently varieties of marine and brackish water species of finfishes and shellfishes are cultured in over one million hectares for food in several Asian countries (Broak, 1991). Aquaculture is one of the fastest growing food production system in the world, which has emerged as an industry possible to supply protein rich food throughout the world (Prasad, 1996). Presently, aquaculture is facing heavy production loss both in hatcheries and grows out systems due to disease outbreak. Further, feed related soluble and solid waste accumulation is also posing environmental problems in aquaculture. Use of probionts has been proposed as a measure to maintain healthy environment in aquaculture and to prevent occurrence of disease (Lipton, 1998). Gut probionts are substances, which contribute to intestinal microbial balance. The probionts are administered to animals with the primary aim of preventing infectious disease by strengthening the action of the gut microflora as well as by enhancing non specific immune system in candidate species. The influence of probionts on the growth response, food utilization and biochemical changes in cultivable finfish species and crustaceans are limited. Hence the present study was taken up to investigate the effect of probionts, (*Bcillus altitudinis* and *Bacillus licheniformis*) and Banana peel powder on growth response, food utilization and biochemical changes in pearl spot, *Etroplus suratensis*. Probiotics help in feed conversion efficiency and live weight gain (Al-Dohail *et al*., 2009; Saenz de Rodriguez *et al*., 2009) and confer protection against pathogens by competitive exclusion for adhesion sites (Chabrillion *et al*., 2005; Vine *et al*., 2004).

Cellulose is the major complex carbohydrate in plant cell walls. Coverings, such as banana peelings, carry most of the cellulose in fruits. Banana peelings are, more often than not, just treated as unnecessary wastes. Banana peel flour can potentially offer new products with standardized composition for various industrial and domestic uses (Bardiya and Somayaji, 1996; Tewari *et al*., 1986; Annadurai *et al*., 2002; Essien *et al*., 2005).

Considering the importance and applications of probiotics, cellulose rich banana peel powder and fish intestinal cellulolytic microbes were added as feed additives. The present study was aimed to analyse the growth and biochemical changes of *Etroplus suratensis*.

2 METHODOLOGY

The branded feed ingredients such as Fish meal, Groundnut oil cake, Wheat bran, Soyameal, Tapioca powder, Vitamin, Mineral mix and cod liver oil were purchased from commercial merchants. In addition to this, probiotics such as *Bcillus altitudinis* and *Bacillus licheniformis* was isolated from the gut of Estuarine Pearl Spot *Etroplus suratensis*. Based on the suitability, different ingredients were selected for feed formulation (Table 1). The feeds were formulated following the square method (New 1987). Three different types of experimental diets (A, B and C) with 40% protein were compounded separately by mixing different ingredients with 2.0% Banana peel powder (experimental diets A and B) and 2.0% CMC (control C) at various proportions. Then the probionts such as *Bcillus altitudinis* and *Bacillus licheniformis* were added as feed additives at 1.0% concentration in feed A

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and B respectively. Feed C was used as the control, without addition of probionts.

3 Results And Discussion

Their protein, carbohydrate and lipid contents varied within a close range (31.38-40.12%, 10.23-13.31% and 5.51-8.46% respectively).

Feed ingredients	Diets (g/100g)		
	Diet A	Diet B	Diet C
Fish meal	33.00	33.00	33.00
Groundnut oil cake	30.00	30.00	30.00
Soya meal flour	20.20	20.20	20.20
Wheat flour	5.60	5.60	5.60
Rice bran	4.20	4.20	4.20
Tapioca powder	3.00	3.00	3.00
Vitamins & minerals	0.50	0.50	0.50
Cod liver oil	1.50	1.50	1.50
Additives	2.00	2.00	2.00
Probiotic bacteria	1.00	1.00	-
Proximate composition (%)			
Protein	38.375± 0.028	40.12± 0.020	31.38± 0.0061
Carbohydrate	12.83± 0.016	13.31± 0.012	10.23± 0.012
Lipid	7.58± 0.016	8.46± 0.016	5.51± 0.016

Table 1. Percentage composition of ingredients (% dry weight) and Biochemical composition (%) of control and experimental diets

The water stability of the formulated experimental diets were tested over a period of 6 hrs by the method of Jayaram and Shetty (1981) and Immanuel *et al.* (1997). As a measure of feed stability, theleaching percentage in the formulated pellet diets was studied (Table 3). From the result, it is inferred that the leaching percentage of diets varied from 9.60 to 14.20%, 10.20 to 13.60% and 10.60 to 16.70% upto 6 hrs of exposure and upon further increase in exposure time, the leaching percentage was high.

Test diets	Stability (% loss)		
	2h	4h	6h
Diet A	9.60	10.20	14.20
Diet B	10.20	10.60	13.60
Diet C	10.60	13.80	16.70

Table 2. Water stability of different diets in different hours. Each value (mean±SD) is a mean of three individual estimates

After acclimatization, the healthy fishes were weighted individually and the initial weight ranged from 15.0±0.20 to 15.13±0.30 g. they were reared at the rate of 3 numbers/ 12 l water and fed at *ad libitum*. The left over food and fecal matters were removed and dried at 800^{0}C in an oven. Four replicates were maintained for each feed randomly. During the experiment, which lasted 41 days, water quality was maintained. During the experimental period of 41 days, the Specific Growth Rate (SGR) of *E.suratensis* fed on dietA was high (1.33±0.85%), dietB (1.32±0.83%) and low (1.25±0.76%) in control (Table 4). The consumption rate of *E.suratensis* fed on control diet was maximum (38.62±0.86mg/g/day) and minimum (28.84±0.56mg/g/day) in dietA and control (Table 5). The production rate of *E.suratensis* was high in probiont dietB fed group (12.9±0.48mg/g/day) whereas, it was low in control diet fed group (10.8±0.26mg/g/day). In probiont dietB fed goup, the production rate was 12.23±0.30mg/g/day (Table 5).

Parameters	Growth response		
	Diet A	Diet B	Diet C
Initial wt (g)	15.13±0.30	15.10±0.20	15.00±0.20
Final wt (g)	27.3±0.30	26.7±0.18	25.8±0.75
Product (g)	12.23±0.30	12.9±0.48	10.8±0.26
Food consumed(g)	39.07±0.76	28.84±0.56	38.62±0.86
FCE (%)	31.48±0.32	42.40±0.23	27.96±0.65
AGR (%)	0.29±0.93	0.29±0.65	0.26±0.69
SGR (%)	1.25±0.76	1.33±0.85	1.32±0.83
FCR	3.1±0.25^a	2.3±0.35^a	3.5±0.23^a

Table 3. Specific growth rate (%) of *E.suratensis* fed with different probiont supplemented diets. Each value (mean±SD) is a mean of four replicates

The biochemical composition of the muscle, gill and gut of the experimental fishes such as protein, carbohydrate and lipid were analysed following the methods of Lowry *et al*., 1951; Roe, 1955 and Folch *et al*., 1957 respectively (Table 2). Then the results obtained were subjected to statistical analysis, following the procedures given in Zar (1974). The muscle, gill and gut biochemical composition of *E.suratensis* after the termination of the experiment is given in Table 6. After experimental period of 41 days, the biochemical composition (protein, carbohydrate and lipid) of experimental fishes (11.66 to 13.87%), compared to the control (8.66%). This present observation is in congruence with the findings of Paulmony (1996). He reported that the probiont yeast supplemented diet significantly influenced the growth, food conversion ratio and specific growth rate of *Cyprinus carpio.*

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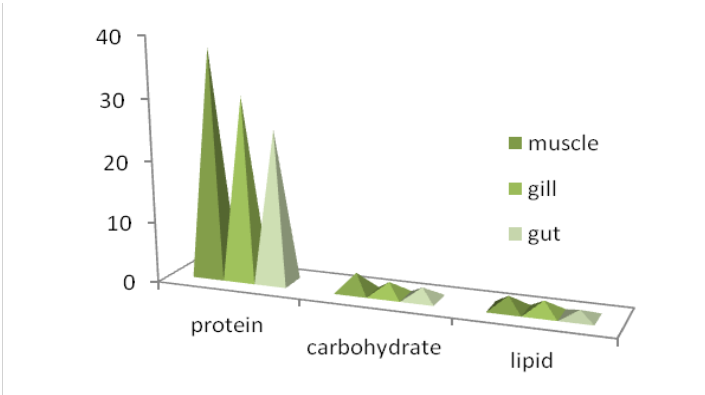

Fig 1. Biochemical composition in the muscle, gill and gut of *Etroplus suratensis* fed on Diet A during 41 days of feeding experiment

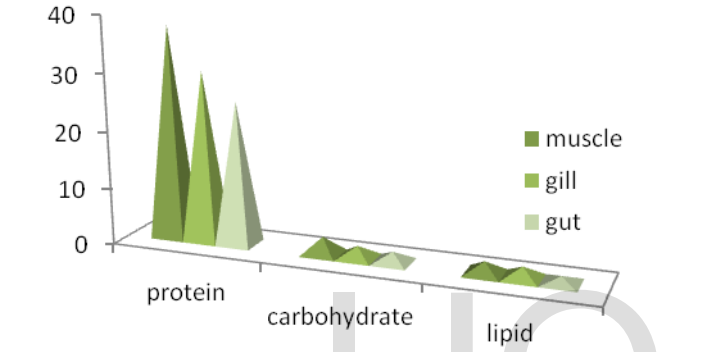

Fig 2. Biochemical composition in the muscle, gill and gut of *Etroplus suratensis* fed on Diet B during 41 days of feeding experiment

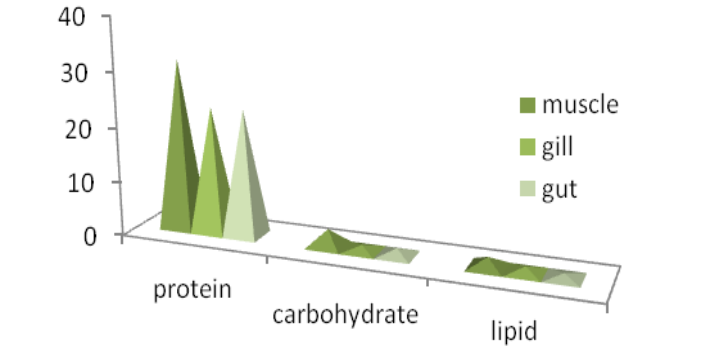

Fig 3. Biochemical composition in the muscle, gill and gut of *Etroplus suratensis* fed on Diet C during 41 days of feeding experiment

Only limited number of studies has been carried out on the influence of probiotics on fish. Addition of probionts such as cellulose in the diet increased the growth rate by accelerating the secretion of certain enzymes *viz*. amylase, alkaline phosphatase etc. in post embryonic *Labeo rohita* (Das, 1975). The present study shows considerable weight gain in *E.suratensis* fed with probiont supplemented diets than control. The percentage weight was increase in experimental diets fishes than control diet fishes. The consumption rate of the three experimental groups did not vary much, but the rate of production varied significantly in fishes fed with these diets. The probionts administrated administrated through diet might choose binding sites in the intestine, preventing colonization by pathogens. So far results with probiotics to reduce disease prevalence among commercially produced finfish, have been disappointing. However, the principles behind their use remain sound and their full potential needs to be explored further.

4 Conclusion

The present work proved the effect of various bacterial probionts and vegetable waste on increased growth of *E.suratensis*. The results will be further used in aquaculture industry for large scale production of *E.suratensis* under controlled environmental conditions. Further more this work can be extended in aspect of application in various other fishes also using different sources of food waste.

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