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BIOPOTENTIAL EFFECTS OF ACTIVE PRINCIPLES FROM *Curcuma longa* ON FRESHWATER PRAWN *Macrobrachium rosenbergii*

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ABSTRACT

Aquaculture is under threat due to various ecological and anthropogenic effects. As highly demanded protein source, people all round the world depends on fishery as a major source of protein food. There numerous candidates are there in the freshwater with high economic values. Freshwater prawn *Macrobrachium rosenbergii* is one of the important species of culture importance. For getting more profit, the intensive culture is preferable. However, the intensive culture is accompanied by several serious diseases. The traditional remedial measures such as antibiotic application etc cause more destruction than relief. The present work lights on the applicability of some indigenous medicinal plants on the *Macrobrachium rosenbergii* as feed additives. *Curcuma longa* is a medicinal plant with numerous medicinal applicability. Here certain active principles from the *Curcuma* were extracted through photochemical extractions methods. After that, the active components were mixed with the basal feeds and checked for the effects of the feeds. The major active components under the study were Curcumin, Demethoxycurcumin and Bisdemethoxy curcumin. The prawns were cultured for a period of 60 days. Through these days, the candidates were supplemented with feed incorporated with above said active principles. The main parameters under study was Nutritional Indices, Feed quality indices, Feed utilization parameters, Biogrowth parameters. From the experiment it was found that feed containing Curcumin was shown effective results as compared with other active principles. On conclusion bioactive phytonutrient, incorporated diets improved the feed intake and assimilation in *M. rosenbergii*. Among the supplemented diets Curcumin incorporated diet expressed the excellent growth promotion properties. Thus the Curcumin can be used as feed additive for growth promoter in aquaculture candidates especially *M. rosenbergii*.

KEYWORDS: *Macrobrachium rosenbergii,* Curcumin, Demethoxycurcumin and Bisdemethoxy Curcumin, Medicinal Plants, Active Principles, Nutritional Indices, Feed Quality Parameters.

Now a day's the application of medicinal plants as a feed additive is gaining momentum. Plant product promote various activities such as antistress, growth promotion, appetite stimulation, immunostimulation, aphrodisiac and antimicrobial properties due to the active principles of as alkaloids, flavanoids pigments, phenolics, terpenoids, steroids and essential oils (Murphy and Austin,2005).Most of the herbs used as feed additives in aquaculture acts as appetite stimulators and growth promoters (Syahidah *et.al.,* 2015). Abdulwahab and El-Bahr (2012), reported the influence of Black cumin seeds (*Nigella sativa*) and Turmeric (*Curcuma longa*) mixture on the growth performance and serum biochemistry of Asian SeeBass, *Lates calcarifer*.The elevation in survival rate was in the order of garlic > ginger > turmeric > fenugreek. Venkatramalingam *et al*. (2007) reported that post larvae of *Penaeus monodon* had significantly higher weight gain and specific growth rate when fed with herbal appetizer, *Zingiber officinalis* enriched *Artemia.* These been reported to exhibit several biological activities in animal and human clinical studies.Curcumin exhibits poor bioavailability (Osho and Lajide, 2012).Behera *et.al*., (2010) reported the immunostimulatory properties of curcumin in fish *Labeo rohita* (H).In the present study evaluated the Nutritional indices, Feed quality indices, Feed utilization parameters, Biogrowth parameters of the feeds incorporated with active principles such as curcumin, demethoxycurcumin and bisdemethoxycurcumin.

MATERIALS AND METHODS

Post larvae of *Macrobrahium rosenbergii* (PL20) *was* purchased from ADAK (Agency for Development of Aquaculture (ADAK), Varkala, kerala**.** Acclimated in laboratory under optimum salinity, pH and temperature. During acclimatization they were fed *ad libitum* with control diet and egg albumin. Reared the prawn until they reached a average size of ~10.00 ± 0.00g.Proper aeration and water quality is maintained. Excreta left over feeds and 50% water was removed daily.Basal feed was prepared by using the ingredients listed in the Table.1.

Tubers of *Curcuma longa (*Zingiberaceae family) was collected from the local stations of Kollam district, Kerala. The collected samples has been identified by Pankaja Kasthuri Ayurveda Research centre, Kattakkada, Trivandrum and samples deposited in herbarium.The rhizomes of *Curcuma longa* were taken for processing, all debris were washed out, cut into small pieces. The sample were allowed for drying in shade. Air

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dried samples were powdered by electronic mill. The extracts prepared as referred by Harborne, 2008. The main active principles such as Curcumin, Demethoxy curcumin (DMC), Bisdemethoxy curcumin (BDMC) were procured from the *Curcuma longa* tubers and by employing HPLC the concentrations were selected. It was conclusive that 25 mg/Kg of *Curcuma longa* showed promising results than other concentrations. Hence the concentrations were maintained as mentioned below.

Test Diet 1 (TD 1) : 0.13 mg of Curcumin per kg of basal feed.

Test Diet 2 (TD 2): 0.057 mg of Demethoxy curcumin per kg of basal feed.

Test Diet 3 (TD 3): 0.105mg of Bisdemethoxy curcumin per kg of basal feed.

Control diet: Basal feed.

The juveniles prawns were cultured for 60 days(in triplicate).After 60 days the prawns were screened for experimental paramters.The main parameters under study were Nutritional Indices, Feed quality indices, Feed utilization parameters,Biogrowth parameters.

RESULTS AND DISCUSSION

The feeding rate is related to the food consumption per day and weight gain. The prawns fed with test diet 1 fed prawns (figure-1) had relatively high feeding rate (6.34±.036). Control prawns had less feeding rate compared to the other treatments (6.00± 0.01). The prawns fed with test diet 1 had high (4.04±0.09) mean absorption. Control prawns had least mean absorption rate compared to the other groups (1.05±0.155). Except in prawns fed test diet 3 (0.14±0.04), all other treatments had relatively similar absorption rate.Mean conversion was high prawns fed with in test diet 1(3.36±0.15). Control prawns (0.82±0.22) had least mean conversion. All the treatments are statistically significant than control groups ($p<0.05$).The highest conversion rate is obtained in prawns fed test diet 1 (0.33±0.33) and least value obtained in control prawns (0.13±0.04). Prawns fed with test diet 1 had high ammonia excretion rate than other treatments (0.61±0.05).Least excretion rate was obtained in control (0.16±0.05) prawns. Test diet 1 fed prawns had high metabolic rate (4.11±0.21) than others. Control prawns (0.40±0.57) had least metabolic rate.

Relative gut length of treated groups were significantly (T-2) higher compared to control group ($p<0.05$). Prawns fed with test diet 1 (0.92± 0.06) had highest relative gut length compared to the control prawns. Control prawns (0.67± 0.08) had lesser gut length compared to others. Test diet1 fed prawns (0.11±0.02) had greater hepatosomatic index. Control prawn had (0.01±0.00) least hepatosomatic index. Intestosomatic Index of the treated groups were not statistically significant ($p<0.05$).Test diet 1(0.02±0.01) and test diet2 (0.02±0.01) fed prawns had highest intestsomtic index. Lowest intestosomatic index was obtained in control prawns(0.003±.0.00).The Intestine protein content of all treated groups were statistically significant ($p>0.05$). The intestine protein content of the treated and control prawns. Test diet 1 fed prawns had relatively higher (75.33±1.00) intestine protein content. The control prawns had least intestine protein(60.33±1.52).Test diet 1 (76.33±1.52) had relatively higher intestine protein content. The control prawn had least hepatopancreas protein(71.88±3.51) content.

Feed conversion ratio is the measure of how much gram of feed is needed to increase the weight of cultured species by one gram. Prawns fed with Test diet 1 (20.94±1.56) had low and better Feed conversion ratio (T-3). Higher FCR values was in control prawns (52.06±2.10).Prawns fed with test diet 2 (1.83±0.12) had highest protein efficiency ratio than other treated groups. Control prawns had less protein efficiency ratios (0.12±0.02).

Test diet 1 (50±0.01) had promising survival rate.In prawns fed test diet 2 had low survival rate than others(25±0.12).(T-4).Relative growth rate of treated groups have significantly increased compared to the control groups ($p<0.05$).Test diet 4 fed groups had comparatively higher RGR values (20.60±1.40). Control prawns had least RGR (2.01±0.01).Higher AGR values obtained in prawns fed test diet 1(0.04±0.02) and least was in control prawns (0.003±.0.015).Test diet 1 fed prawns had higher SGR (3.90±0.30).In control prawns the SGR is very low(0.33±0.200). ADGR is not significant in the treated groups ($p>0.05$). The average daily growth rate is high in test diet 1 fed prawn (0.05±0.02).In control groups the Average daily growth rate is relatively less (0.003±0.00).Test diet 2 fed prawns had relatively high feed efficiency (22.58±1.94) values. Control group had low FE values (1.86±0.25). Gross Conversion Efficiency (GCE) is one of the parameters to test the nutritional excellence.GCE of prawns fed with test diet 1 had highest GCE (60.89±3.43).Test diet 3 fed prawns had very low GCE (8.78±1.33) compared with the other treatments.

There are numerous works dealing with the effects of medicinal herbs as a feed additives and growth

stimulator .Application of crude extracts of *C.longa* on *Macrobrachoium rosenbergii* was also effective. (Poongodi , 2012) Curcumin is the major content in *C.longa,* responsible for the color and most of the pharmacological effects of *C.longa* (Borra *et.al.,* 2014). In the nutritional indices studies, the Curcumin supplemented prawns showed comparatively higher values.Feed conversion ratio and protein efficiency ratio are the two parameters under the study of feed quality indices. In the present study curcumin supplemented prawns obtained effective FCR and PER. Rebecca ,2014 tested the Growth promotion and survival enhancement of the freshwater prawn *Macrobrachium rosenbergii* post larvae fed with A*llium sativum, Zingiber officinale* and C*urcuma longa. A. Sativum*, *Z. officinale*, and *C. longa*. All the herbal incorporated diets increased feed intake and a better quality of the feed has resulted in better nutritional status of the diet-fed animals. *C. longa* served as a good source of non-enzymatic antioxidants and enhanced the survival of the freshwater prawns. Therefore, it is suggested that these herbs can be used as cheap and safer alternatives against synthetic hormones and antibiotics for its growth and survival also improves the all growth promotion properties .Manju *et.al.,* 2008, 2009 tested the growth promotion and nutritional efficacy of curcumin in *Anabas* and the effectiveness. Here also Curcumin fed samples shown more excellent feed utilization parameters . Here also the herbal incorporated diet showed more effectiveness than control group. Excretion rate was higher in treated groups, this can be correlated with increased food consumption, lead to increased metabolic rate and all other metabolic parameters. Curcumin treated groups have shown good biogrowth. Poongodi*,* 2012, conducted a study to check the effectiveness of growth promoting potential of garlic, ginger, Turmeric and fenugreek on the freshwater prawn *Macrobrachium rosenbergii.* High excretion rate was also a good indication of metabolic activity was higher in PL fed with herbals supplemented diet. This can be feed consumption rate. The herbal supplemented diets will increase the metabolic rates (Behra *et.al.,* 2012).On conclusion bioactive phytonutrient incorporated diets improved the feed intake and assimilation in *M. rosenbergii*. Among the five supplementation groups Curcumin incorporated diet expressed the excellent growth promotion properties. Thus the Curcumin can be used as feed additive for growth promoter in aquaculture candidates especially *M. rosenbergii*.

Table 1: Ingredients of experimental feed (FAO, 1978).

Ingredients	Quantity (mg/kg)
Fish Meal	300
Prawn Head	50
Squid Meal waste	50
Squilla	50
Soyabean Meal	250
Wheat Flour	250
Fish Oil	30
Vitamin Mineral Mixture*	20

Table 2: Biogrowth parameters of prawns supplemented with the bioactive phytonutrients from *C.longa.*

	TD 1	TD 2	TD 3	Control
Relative Gut Length(RGL)	0.92± 0.06	0.82± 0.05	0.75± 0.04	0.67± 0.08
Hepato Somatic Index(HSI)	0.11± 0.02	0.09±0.06	0.08± 0.01	0.01±0.00
Intesto Somatic Index(ISI)	0.02±0.01	0.02±0.01	0.01±0.00	0.003±.0.00
Intestine Protein Content(IPC)	75.33±3.51	68.00±2.65	70.67±1.52	60.33±1.52
Hepatopancreas Protein Content(HPC)	76.33±1.52	74.00±2.00	74.67±2.08	71.88±3.51

Table.3. Feed quality indices of prawns supplemented with the bioactive phytonutrients from *C.longa.*

	TD 1	TD 2	TD 3	Control
Feed Conversion Ratio	20.94±1.56	28.33±1.52	36.91±1.70	52.06±2.10
Protein Efficiency ratio	1.08±0.16	1.03±0.03	0.39±.052	0.12±0.02

Table 4: Nutritional Indices of prawns supplemented with the bioactive phytonutrients from *C.longa*.

	TD 1	TD 2	TD 3	control
Survival (%)	50±0.01	25±0.12	40±0.23	33±0.36
Relative Growth Rate(RGR)	16.01±0.92	6.41±0.44	12.14±0.75	2.01±0.01
Absolute Growth Rate(AGR)	0.04±0.02	0.02±0.015	0.02±0.01	0.003±.0.02
Specific Growth Rate(SGR)	3.90±0.30	2.00±0.15	1.83±0.08	0.33±0.20
Average daily Growth Rate(ADGR)	0.05±0.02	0.02±.010	0.02±0.015	0.003±0.00
Feed Efficiency(FE)	14.36± 1.98	22.58±1.94	10.41±0.79	1.86±0.25
Gross Conversion Efficeincy(GCE)	60.89±3.43	31.84±1.76	8.78±1.33	22.78±2.54

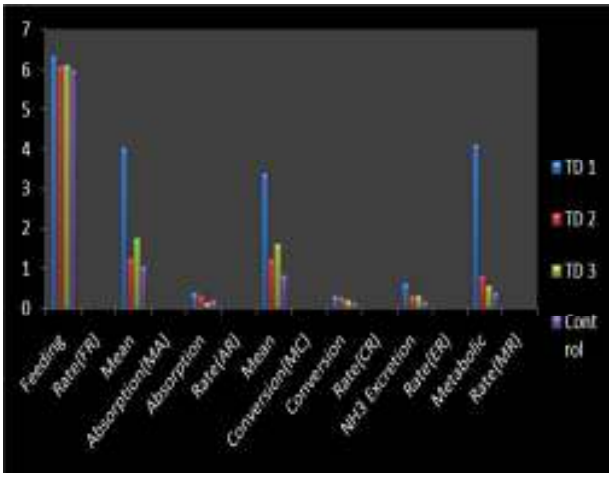

Figure 1: Feed utilization parameters of prawns supplemented with the bioactive phytonutrients from *C. longa* and *C. asiatica.*

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