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AN EVALUATION INTO THE GROWTH AND NUTRITIONAL EFFICACY OF BIOACTIVE CURCUMINOIDS ON ORAL SUPPLEMENTATION IN *MACROBRACHIUM ROSENBERGII*

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ABSTRACT

As any other water resources freshwater system is also getting polluted due to various reasons. These will severely affect the heath of many freshwater organisms. The disease outbreaks also increased due to the intensive farming. Fresh water prawn is one of the organism with highest demand. In the present study we evaluated certain nutritional status of freshwater prawn incorporated with certain medicinal plants as feed additives. *Macrobrachium rosenbergii* was fed with feed incorporated with curcumin, demethoxycurcumin, bisdemethoxycurcumin and cultured for a period of 60 days. After that the prawns were tested for the feed quality indices, feed utilization parameters, biogrowth parameters. The main incorporated active principles are curcumin, demethoxycurcumin, bisdemethoxycurcumin from *Curcuma longa*.

KEYWORDS: *Macrobrachium rosenbergii*, curcumin, demethoxycurcumin, bisdemethoxycurcumin, feed utilization parameters and *Curcuma longa*.

INTRODUCTION

Most of the herbs used as feed additives in aquaculture acts as appetite stimulators and growth promoters.[12] Several researches are carried out to find out new compounds in phytonutrients which increase the all over performance of aquaculture candidates. The herbs perform their initial activity in feeding as a flavor and thereby influence eating patterns, the secretion of digestive fluids and total feed intake. The stimulation of digestive secretions including saliva, digestive enzymes, bile and mucus is considered to be an important action of feed additives.[1] reported the influence of *Nigella sativa* and Turmeric mixture on the growth performance and serum biochemistry of *Lates calcarifer*. To determine the growth performance of *Macrobrachium rosenbergii* post larvae (PL) on *Allium sativum* (Garlic), *Zingiber officinale* (Ginger), *Curcuma longa* (Turmeric) and *Trigonella foenum-graecum* (Fenugreek) incorporated diets is documented.The elevation in survival rate was in the order of garlic > ginger > turmeric > fenugreek. According to[5] the use of various herbs such as *Hygrophila spinosa, Wthania somnifera, Zingiber. officinalis, Solanum trilobatum, Andrographis paniculata, Psoralea corylifolia, Eclipta erecta, Ocimum sacnctum, Picrorhiza kurooa, Phyllanthus niruri, Tinospora cordifolia,* have a good influence in the *Penaeus* larviculture due to the feed and growth stimulator, antistress, immunostimulation, and antibacterial characteristics. In another study turmeric extract in Black Tiger Shrimp *Penaeus monodon* showed better resistance against *V. harveyi.* Phenoloxidase activity of shrimps fed with 25 and 50 mg/kg feed of turmeric extract was significantly ($P<0.05$) higher than the control.

Curcuminoids refer to the main chemical substances, namely curcumin, demethoxycurcumin, and bis-demethoxycurcumin. These been reported to exhibit several biological activities in animal and human clinical studies.[11] Curcumin, a polyphenolic compound derived from dietary spice turmeric, possesses diverse pharmacologic effects including anti-inflammatory, antioxidant, antiproliferative and antiangiogenic activities. Curcumin at low doses 15 and 1.5 µg significantly increased some non-specific immune parameters such as respiratory burst, myeloperoxidase, haemagglutination, haemolytic and bacterial agglutination activities upto 21 days post administration without any side effects. In the present study we evaluated feed quality indices, feed utilization parameters, biogrowth parameters of active principles such as curcumin, demethoxycurcumin, bisdemethoxycurcumin incorporated *Macrobrachium rosenbergii.*

MATERIALS AND METHODS

Experimental Procedure

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 ~10.00g . After that the prawns were reared in separate tanks. Each tanks contains 10 prawns Through proper aeration, water quality was maintained. Excreta left over feeds and 50% water was removed daily.

Feed was prepared by using the ingredients listed in the Table**.**1. The main active principles used in the present study was Curcumin, Demethoxy curcumin(DMC), Bisdemethoxy curcumin(BDMC) from *Curcuma longa* .from our standardization studies[12] it was conclusive that 25 mg/Kg of *Curcuma longa* at daily administration showed promising results than other concentrations. Taking it as a standard and also from phytochemical analysis, the concentrations of Curcumin, Demethoxy curcumin(DMC), Bisdemethoxy curcumin (BDMC) was taken for feed preparation. Feed modifications are as follows:

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 : Basal (control) feed.

After the experimental duration of 60 days the scampi were checked for the following parameters. Feed quality indices,[4] Feed utilization parameters,[3] Biogrowth parameters.[9]

Data were statistically analyzed for mean and standard deviation. The data were subjected to One- way analysis of variance (ANOVA) using SPSS version 16.0. One-way ANOVA was used to test whether differences between groups existed between parameters. In all test, $P<0.05$ was considered as significant.

RESULTS

The data obtained as per the details given in materials and methods are reported in Table.1. to Table.2.and Figure.1. to Figure.2.

Table 1: Proximate analysis of experimental feeds.

	Crude protein(%)	Crude lipid(%)	Moisture(%)	Dry matter(%)	Ash(%)	Fibre(%)	NFE(%)	Gross energy(Kj/g)	ME:DE Coefficient(Kj/g)	Metabolizable energy(%)
TD 1	40.10	7.54	1	99	8.20	0.065	43.10	16.80	99.46	15.01
TD 2	39.86	7.00	6.5	93.5	8.70	0.003	37.94	15.78	99.42	14.13
TD 3	39.76	6.80	9	91	8.60	0.002	35.84	15.38	99.47	13.65
Control	39.06	6.98	8	92	8.45	0.003	37.51	15.56	99.45	13.93

Lowest FCR is the indication of better feed. Prawns fed with TD 1 (20.94±1.56) had low and better Feed conversion ratio (Table.1). Higher FCR values was in control prawns (52.06±2.10). The protein efficiency ratio is defined as the gain in weight per gram of protein eaten. Table.1. represents the protein efficiency ratio of treated and control groups. Prawns fed with TD 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).

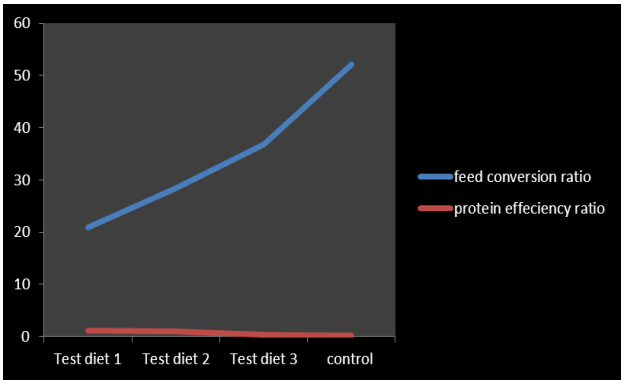

Figure 1: Feed quality indices of prawns supplemented with the bioactive phytonutrients from *C.longa*.

Main feed utilization parameters under study were feeding rate(FR), mean absorption(MA), absorption rate(AR), mean conversion(MC), conversion rate(CR), excretion rate(ER) and metabolic rate(MR)(Table.2.). These parameters deals with how much food is fed, absorbed, assimilated, converted and how much is excreted. The feeding rate is related to the food consumption per day and weight gain. The prawns fed with TD 1 fed prawns had relatively high feeding rate (6.34±.036). Other treatments had more or less similar range of feeding rate. Control prawns had less feeding rate compared to the other treatments (6.00± 0.01).Mean Absorption is related to the mean food consumption per day and food excreted as faeces. The prawns fed with TD 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 TD 3 (0.14±0.04), all other treatments had relatively similar absorption rate. From these TD 1 fed prawns (0.46±.04) had relatively highest absorption rate. Mean conversion was high prawns fed with in TD 1(3.36±0.15). Control prawns (0.82±0.22) had least mean conversion. The highest conversion rate is obtained in prawns fed TD 1 (0.38±0.33) and least value obtained in control prawns (0.13±0.04) .Excretion rate is the mean ammonia excretion per day in relation to initial live weight of the prawn. All the treatments are statistically significant ($p<0.05$). Prawns fed with TD 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. Metabolic rate is high (4.11±0.21) than others. Control prawns (0.40±0.57) had least metabolic rate.

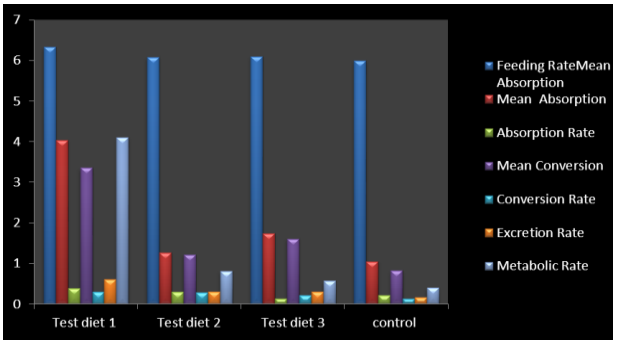

Figure 2: Feed utilization parameters of prawns supplemented with the bioactive phytonutrients from *C.longa*.

The main biogrowth parameters under study was Relative gut length(RGL), hepatosomatic index(HIS), intestosomatic index(ISI), intestine protein content(IPC) and hepatopancreas protein content(HPC) (Table.2) 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. Hepatosomatic Index of all treated groups were statistically significant ($p<0.05$).Test diet 1 fed prawns (0.23±0.02) had greater hepatosomatic index. Control prawn had (0.01±0.00) least hepatosomatic index. Test diet 1(0.02±0.01), 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 ($p>0.05$). Test diet 1 fed prawns had relatively higher (80.00±1.00) intestine protein content. The control prawns had least intestine protein(60.33±1.52). Test diet 1 (76.33±1.52) fed prawns had relatively higher intestine protein content. The control prawn had least hepatopancreas protein(71.88±3.51) content.

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

	Test diet 1	Test diet 2	Test diet 3	Control
Relative Gut Length(RGL)	0.92±0.01	0.82±0.42	0.75±0.01	0.67±0.01
Hepato Somatic Index(HSI)	0.11±0.01	0.09±0.01	0.08±0.01	0.01±0.01
Intesto Somatic Index(ISI)	0.02±0.02	0.02±0.01	0.01±0.02	0.003±0.01
Intestine Protein Content(IPC)	75.33±1.00	68.00±1.84	70.67±1.00	60.33±1.00
Hepatopancreas Protein Content(HPC)	76.33±0.01	74.00±0.01	74.67±1.02	71.88±1.28

ANOVA table showing Biogrowth parameters of prawns supplemented with the bioactive phytonutrients from *C.longa*.

ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Groups	125.2155	3	41.73851	0.031914	0.992253	2.769431
Within Groups	73239.68	56	1307.851			
Total	73364.9	59				

DISCUSSIONS

There are numerous works dealing with the effects of medicinal herbs as a feed additives and growth stimulator.[1,7] Application of crude extracts of *C.longa* on *Macrobrachoium rosenbergii* was also effective.[7,8] The effect of curcumin supplementation in aquaculture feeds is gaining momentum.[9] Curcumin is the major content in *C.longa,* responsible for the color and most of the pharmacological effects of *C.longa* .Demethoxy curcumin and bisdemethoxy curcumin was also the leading active ingredients with medicinal properties.In morphometric analysis curcumin and asiaticcosside treated groups have shown significant improvement. From the results it was clear that Curcumin had the growth promotion property as reflected by biogrowth patamerters. In the nutritional indices studies, the Curcumin supplemented prawns showed comparatively higher values. Previous works from[9] revealed the growth promotion and nutritional efficacy of curcumin.

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. Control prawns showed least feed quality indices.[10] 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[3,8] tested the growth promotion and nutritional efficacy of curcumin in *Anabas* and the effectiveness. Here 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,[9] conducted a study to check the effectiveness of growth promoting potential of garlic, ginger, turmeric and fenugreek on the freshwater prawn *Macrobrachium rosenbergii*. Turmeric have growth promotion and feed utilization parameters on *M.rosenbergii*.[2,3,6] In the present study , the partitioning of ingested energy was recorded in terms of feeding rate, mean absorption, absorption rate, mean conversion, conversion rate, ammonia excretion rate, metabolic rate($p<0.05$).Feeding rates are also important for growth, body activities and chemical composition of the body.[3] Absorption and assimilation was also high in treated groups. 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. In the present study, the metabolic rate was higher in curcumin supplemented diets.

CONCLUSION

On conclusion bioactive phytonutrient incorporated diets improved the feed intake and assimilation in *M.rosenbergii*. Among these 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*.

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