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THE EFFECT OF REPLACEMENT OF FISH MEAL BY SHRIMP WASTE MEAL (SWM) ON GROWTH, TOTAL CAROTENOID AND PROXIMATE COMPOSITION OF KOI CARP (*CYPRINUS CARPIO HAEMATOPTERUS)*

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ABSTRACT
To evaluate the effects of complete replacement of Fish Meal (FM) protein by Shrimp Waste Meal (SWM) on the growth, carotenoid and Proximate composition of Koi carp, diets containing 0, 25, 50, 75 and 100% Shrimp Waste Meal (SWM) were fed to triplicate groups of fish with an initial mean weight 3.25 ± 0.03 g/fish under tap water for the 60 days. Fish fed diet containing 100% SWM exhibited the lowest Specific Growth Rate (SGR).Where as highest was recorded in 50% SWM. The fish fed 25 and 50% SWM had better Feed Conversion Rate (FCR) value than those fish fed with 75 and 100% SWM supplement. There was no significant difference in weight gain among the fish fed diets with 75% and 100% SWM. The highest body protein content was observed in fish fed diets with 25 and 50% SSM compared to the initial fish. The lowest total protein content was obtained with the fish fed diet with 100% SSM. The highest survival was recorded in 50%. There were no significant differences in total lipid content and carbohydrate content among the fish fed diet with 25% to 100%. The highest cartenoid content (0.181 ± 0.008 mg/100g) was recorded in 100% of fish fin. Lowest range was recorded in control. According to the present study, it was concluded that SWM is a promising alternative protein source to fish meal in Koi carp. SWM can effectively replace fish meal up to 50% in the diet of Koi carp.

KEY WORDS
Cyprinus Carpiohaematopterus, Carotenoid content, Growth parameters, Proximate composition and Shrimp waste meals.

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INTRODUCTION[1]

Ornamental fishes have traditionally been fed with live feed, which were often nutritionally deficient and can act as the transmitter of diseases (parasitic, bacterial and viral) if not stored properly[1].Among commonly used feed ingredients, fish meal is considered to be the best ingredient due to its compatibility with the protein requirement of fish[2].

Replacement of fish meal with cheaper ingredients of either vegetable or animal origin in fish feed is necessary because of rising cost and uncertain availability of fish meal[3].

Shrimp waste is basically the dried waste of shrimp industry, consisting of the heads, appendages and exoskeleton and is particularly rich in lysine and chitin Stimulated by increasing shrimp production from catches and farming, shrimp waste meal (SWM) has been identified as an animal protein source of considerable potential[4]. However, the use of SWM may be restricted due to its high fiber, chitin and ash content have been found to reduce crustacean meal digestibility in tilapia[5]. The shrimp shell meal is used as a natural source of carotenoids for the flesh pigmentation especially to give the pinkly colour of the salmonids before to be commercialised. This meal is also used as a growth factor. The Carotenoids are among the nutrients which must be supplied to fish with feed and once ingested they are observed mainly in the median and terminal part of the intestine and then transported by lipoproteins[6]. The absorption and distribution of carotenoids in fish is influenced not only by species but also by age and physiological state, feed type, and the environment inhabited by the fish[7].The present study deals with the evaluate the effect of replacement of fish meal by Shrimp Waste Meal (SWM) on growth, survival, carotenoid and proximate composition of Koi carp (*Cyprinus Carpiohaematopterus).*

MATERIALSAND METHOD

Diet Preparation

The experimental diets composed of the basic ingredients like groundnut oil cake, wheat flour, rice bran, soybean powder, sunflower oil, multivitamin mix, shrimp waste meal are shown in Table No.1. Shrimp waste was collected from Nila Sea Food, Thoothukudi. It was sun dried and powdered. Using the ingredients, the diet with 40% protein was prepared. Four Experimental diets (E1-E4) and control diet (c) were formulated.

C – Control diet
E1 – 25% shrimp waste substituted diet
E2 – 50% shrimp waste substituted diet
E3 – 75% shrimp waste substituted diet
E4 – 100% shrimp waste substituted diet

The ingredients were added and a trough was made by adding warm water. By using pelletizer, pellets were dried and stored in dry plastic containers.

Experimental Design

Healthy fingerlings of Koi carp (3.52 ± 0.03g) were procured from Saravanan Aquarium, Sawyerpuram and collected fishes were acclimatized for 7 days and then randomly distributed into triplicate glass tanks 50L at 20 fish/tank, at the Kamaraj College, Tuticorin, Tamilnadu, India. Triplicate was maintained. One control and 4 experimental groups (E1-E4) were maintained. Fishes were feed with the experimental diets two times a day (9.00am and 4.00pm) at 5% body weight per day twice daily for 60 days. After each feeding, all uneaten feeds were removed one hour later by pressure sucking using plastic tubes. Temperature, pH and dissolved oxygen were monitored using mercury in glass thermometer, pH meter and oxygen meter respectively. Weekly batch weighing of all fish per tank was done using electronic top-loading balance and feed ration was adjusted to accommodate weight changes.

Growth parameters

Growth response parameters were calculated as follows: WG (weight gain, %) = 100 (Final mean body weight - Initial mean body weight)/initial mean body weight; specific growth rate (SGR, % day-1) = ((In Wt- In Wi) /T) x 100, where Wt is the weight of fish at time t, Wi is the weight of fish at time 0 and T is the rearing period in days; feed conversion rate (FCR) = total dry feed fed g fish-1 / total wet weight gain g fish; Average Daily growth rate (g) = (final weight-Initial weight)/ No. of days ; Relative weight gain =(Final weight - Initial weightx100) /Initial Fish Weight Survival rate (%) = 100 (number of fish which survived/initial number of fish).

Carotenoid and Proximate composition analysis

Total carotenoid content of fish in the fins, skin and muscle of *Cyprinus Carpiohaematopterus* were analysed by following the method[8]. The proximate composition were analysed based on AOAC 1984[9]. Crude protein was determined by Lowry[10]. Crude lipid was determined by chloroform-methanol (2:1, v/v) extraction method[11].

Statistical Analysis

The data on growth, carotenoid and proximate composition of fish were analyzed using the statistic system (SPSS) by one-way analysis of variance (ANOVA). The treatment effects were considered significant at $P < 0.05$, Duncan's multiple range tests was used to compare significant difference among the treatments.

RESULTS

Growth and Survival

The mean weight gain, Feed Conversion Rate (FCR), Specific Growth Rate (SGR), Average Daily Growth (ADG) and Survival Rate of the Koi carp fed treatment diets are shown in Table No.2. The highest growth performance ($P<0.05$) was obtained with E2 (50% SWM replacement) followed by E1 (25% SWM replacement) and Control. Lowest responses were obtained with E3 and E4. There was no significant difference ($P>0.05$) in weight gain among the fish fed diets with E3 and E4 (75% and 100% SWM replacement). Fish fed diet containing 100% Shrimp Waste Meal (SWM) showed the lowest SGR (0.32±0.02). The FCR of the fish fed the tests diets followed the same general pattern as the weight gain. The fish fed 50% and 25 % SWM had better FCR value than those fish fed with 75% and 100% SWM supplement. During the 60-days feeding trial, mortality was observed with each type of feed, including the control feed. Table 2 shows, the survival of juveniles ranged from 97% to 99%.

Proximate composition

The Proximate composition of whole fish is shown in Table No.3. The inclusion of SWM in Koi carp diets significantly ($P<0.05$) affected final fish body composition. The body protein content was significantly ($P<0.05$) higher in fish fed diet containing 25% (15±0.15) and 50% (14.9±0.12) compared to the body protein content of the initial fish. The lowest body protein was obtained in the fish fed diet containing100% (13.1±0.12). Among the experimental group, there were no significant differences ($P>0.05$) in body protein content among the fish fed diet with Control, 75% and 100%. There were no significant differences ($P>0.05$) in body lipid content and carbohydrate content among the fish fed diets.

Total carotenoid in Fish Tissue

After 60 days of feeding the carotenoid in fish, feed with supplemented diets showed better carotenoid than the control fish (Table No.4). Fin showed better carotenoid than skin and muscles in all the fish feed with control and experimental diets. Highest carotenoid content (0.181 ± 0.008 mg/100g) was recorded in 100% of fish fin. Lowest range was recorded in control.

DISCUSSION

The results of the study indicated that growth of fish increases up to 50% SWM replacement. Although SWM inclusion resulted in carcass protein and fat deposition (Table No.3), these results are similar to those reported by Plascencia-Jatomea[12], who found body crude lipid content ranging from 53.6 to 67.2 in Nile tilapia fed diets containing shrimp head hydrolysate by fermentative silage. [13]Showed that properly processed shrimp meal can be used in relatively high levels in place of SBM (Soya Bean Meal) in layer diets without negatively affecting bird performance.[14]Indicated that Crustacean Waste Products (CWP) may be recommended as an alternative to FM (fish meal) sparing in Rainbow trout diets, but that partial replacement requires amino acid supplementation.

[15]Indicated that the best profit margin would be realized by replacing fish meal with 30% fermented shrimp head meal (FSHM) in the diet of C. *gariepinus*. In concluded that shrimp protein silage could be included in tilapia diets at concentrations as high as 15%, improving fish growth rate. They demonstrated that 6% of shrimp protein hydrolysate (SPH) can be included in diets for Nile tilapia without reducing growth performance. In the present study total replacement of fish meal by SWM depressed growth performance of Koi carp. Moreover, these results may be attributed to the high levels of chitin found in SWM[16]. Suggested that the importance of inclusion of crustacean meal as dietary supplement to enhance. The pigmentation of fish and crustacean shrimps has the ability to convert beta carotene to astaxanthin[17]. Maximum carotenoid

(0.181 mg/100mg) was seen in the fin of fish fed with 100% SWM replaced diet. Shrimp meal played a predominant role in the carotenoid of fish. The supplementation of shrimp meal, containing a mixture of natural carotenoid with an apparent predominance of astaxanthin improved carotenoid in Red porgy[18]. The body protein content was significantly ($p<0.05$) high in 25 and 50% SWM replacement diets.

Table No.1: Formulation of Control and Experimental Diets (%)

S.No	Ingredients (g)	Experimental Diets				
		Control	E 1 (25%)	E 2 (50%)	E 3(75%)	E 4(100%)
1	Fish Meal	40	30	20	10	-
2	Shrimp Waste	-	10	20	30	40
3	Ground Nut Oil Cake	15	15	15	15	15
4	Soya Bean Powder	22	22	22	22	22
5	Rice Bran	10	10	10	10	10
6	Wheat Flour	10	10	10	10	10
7	Sun Flower Oil	1	1	1	1	1
8	Multi Vitamin. Mix	2	2	2	2	2

Table No.2: Growth performance of *Cyprinus Carpiohaematopterus*

S.No	Parameters	Control	E1	E2	E3	E4
1	Weight Gain	0.88 ± 0.03^{a}	1.03 ± 0.10^{a}	1.12 ± 0.04^{b}	0.86 ± 0.02^{a}	0.82 ± 0.04^{b}
2	ADG[1]	0.029 ± 0.00^{a}	0.034 ± 0.002^{b}	0.037 ± 0.001^{a}	0.018 ± 0.002^{c}	0.027 ± 0.001^{a}
3	RWG[2]	27.16 ± 0.10^{a}	32.08 ± 0.15^{c}	34.04 ± 0.32^{a}	26.46 ± 0.31^{b}	25.07 ± 0.12^{c}
4	FCR[3]	1.7 ± 0.05^{a}	1.45 ± 0.35^{a}	1.30 ± 0.03^{a}	1.74 ± 0.07^{b}	1.82 ± 0.035^{a}
5	SGR[4]	0.34 ± 0.03^{b}	0.43 ± 0.04	0.42 ± 0.04^{c}	0.33 ± 0.03^{a}	0.32 ± 0.02^{a}
6	Survival (%)	97	99	99	98	97

[1]ADG –Average daily Gain, [2]RWG-Relative Weight Gain, [3] FCR-Feed conversion Ratio, [4]SGR-Specific conversion Ratio.

Table No.3: Proximate Composition of Fish after 60 days

S.No	Treatment	Protein	Carbohydrate	Lipid
1	Initial	12 ± 0.05^{a}	6.2 ± 0.08^{b}	15 ± 0.11^{a}
2	Control	12.5 ± 0.1^{a}	6.7 ± 0.08^{c}	14 ± 0.2^{a}
3	Experimental 1 (25%)	15.2 ± 0.15^{a}	6.9 ± 0.09^{a}	13.9 ± 0.14^{b}
4	Experimental 2 (50%)	14.9 ± 0.12^{a}	7.1 ± 0.08^{b}	13.7 ± 0.12^{a}
5	Experimental 3 (75%)	13.4 ± 0.14^{a}	7.1 ± 0.1^{b}	13.6 ± 0.1^{a}
6	Experimental 4 (100%)	13.1 ± 0.12^{a}	7.2 ± 0.09^{a}	13 ± 0.1^{b}

Table No.4: Total Carotenoid Content (mg/100mg) in Fish Fed With Control and Experimental Diets

S.No	Treatment	Muscle	Skin	Fin
1	Initial	0.041 ± 0.06^{a}	0.112 ± 0.004^{a}	0.11 ± 0.007^{b}
2	Control	0.061 ± 0.004^{a}	0.128 ± 0.007^{b}	0.121 ± 0.005^{a}
3	Experimental 1	0.089 ± 0.005^{a}	0.135 ± 0.008^{b}	0.129 ± 0.004^{a}
4	Experimental 2	0.091 ± 0.009^{a}	0.146 ± 0.003^{a}	0.136 ± 0.006c
5	Experimental 3	0.098 ± 0.005^{a}	0.156 ± 0.006^{a}	0.154 ± 0.009^{a}
6	Experimental 4	0.112 ± 0.009^{a}	0.178 ± 0.005^{a}	0.181 ± 0.008^{a}

CONCLUSION

Conclusion of the present study was fish meal of feed was replaced with shrimp waste meal at different concentrations (25%, 50%, 75%, 100%) and Growth rate, survival, carcass composition and carotenoid content were higher in 50% SWM replacement. Even though there was no significant difference (P>0.05) in carbohydrate and lipid content of fish 50% SWM replacement is recommended for best growth and colouration of Koi carp.

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BIBLIOGRAPHY

1. Pannevis M C. Nutrition of ornamental fish, In: I.H. Burger (Ed.), The Waltham Book of Companion Animal Nutrition, *Pergamon Press, Oxford,* 82, 1993, 96-99.
2. Alam A K, Maughan W J. Growth response of indigenous and exotic carp species to different protein sources in pelleted feeds, *Aqua. Res,* 27(9), 1996, 673-679.
3. Higgs D A, Dosanjh A F, Prendergast R M, Beams R W, Hardy W. Nutrition and Utilization Technology in Aquaculture, *Champaign II. Chapman and Hall. Company, New York, USA***,** 41, 1995, 130-156.
4. Fox C J, Blaw P, Brown J H, Watson I. Feed Ingredients for Warm water Effects of Various Processing Methods on the Physical and Biochemical Properties of Shrimp Head Meals and their Utilization by Juvenile *Penaeus monodon* Fab, *Aquaculture,* 122, 1994, 209-226.
5. Koprucu K, Ozdemir Y. Apparent digestibility of selected feed ingredients for Nile tilapia (*Oreochromis niloticus*), *Aquaculture,* 25, 2005, 308-316.
6. Ando S. Studies on the food biochemical aspects of changes in chum Salmon, *Oncorhynchus keta* during spawning migration: mechanisms of muscle deterioration and nuptial coloration - Reprinted from Memories of the Faculty of Fisheries, *Kokkaid University,* 33(1/2), 1996, 1-95.
7. Gupta R K, Srivastava B S, Srivastava R. Comparative expression analysis of rpf-like genes of Mycobacterium tuberculosis H37Rv under different physiological stress and growth conditions, *Microbiology*, 156, 2010, 2714-2722.
8. Bjerkeng B, Storebakken T, Liaaen Jensen S. Pigmentation of rainbow trout from start feeding to sexual maturation, *Aquaculture,* 108, 1992, 333-436.
9. AOAC. Official methods of analysis of the Association of Official Analytical Chemists 1984, 14th edition, Washington D.C.
10. Lowry O H, Rosebrough A J, Farr A L, Randall R J. Protein Measurement with the Folin Phenol Reagent, *J. Biol. Chem*, 193, 1951, 265-275.
11. Folch J, Lees M, Stanley G H S. A simple method for the isolation and purification a total lipids from a animal tissues, *J.Biolo.chem*, 226, 1956, 497-509.
12. Plascencia-Jatomea M, Olvera-Novoa M A. Feasibility of fishmeal replacement by shrimp head silage protein hydrolysate in Nile tilapia

(*Oreochromis niloticus L.)* diets, *J. Sci. Food Agric*, 82, 2002, 753-759.
13. Grenat A G. The Effect of Using Different Levels of Shrimp Meal in Laying Hen Diets, *Poultry Scienc*, 80, 2001, 633-636.
14. Ozogul Y. The Possibility of Using Crustacean Waste Products (CWP) on Rainbow Trout (*Oncorhynchus mykiss*), *Feeding Turk J. Biol*, 24, 2000, 845-854.
15. Nwanna L C. Nutritional Value and Digestibility of Fermented Shrimp Head Waste Meal by African Catfish *Clarias gariepinus*, *Pak. J. Nutr*, 2, 2003, 339-345.
16. Shahidi F, Wana sundara U.N.Omega-3-Fatty acid concentrates nutritional aspects and production on technological, *Trends in food science and technology*, 9, 1998, 60-240.
17. Boonyaratpalin M, Unprasert N. Effects of pigments from different sources on color change and growth of red, *Oreochromis niloticus*, *Aquaculture*, 79, 1989, 375-380.
18. Cejas J R, Almansa E, Tejera N, Jerez S, Bolannos A, Lorenzo A. Effect of dietary supplementation with shrimp on skin pigmentation and lipid composition of red porgy (*Pagrus pagrus*) alevins, *Aquaculture*, 218, 2003, 457-469.