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Effect of Varying Levels of Protein From Different Plants Sources on Growth and Survival of Carp, *Cirrhinus Mrigala* Reared in Cemented Cisterns.

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Abstract: A total of 210 *Cirrhinus mrigala* fingerlings were distributed in completely randomized way into six treatments with 3 replicates each to determine the effect of protein from different plant sources on the growth and body composition of *C. mrigala*. Six experimental protein diets of varying protein level were formulated utilizing rice protein and rice bran viz.; as plant protein source like rice protein with 30% protein (RP30), rice protein with 35% protein (RP35) and rice protein with 40% protein (RP40). Similarly rice bran as protein source like rice bran with 30% protein (RB30), rice bran with 35% protein (RB35) and rice bran with 40% protein (RB40). Controlled group diet contained a balanced mixture of proteins from both plant sources. The daily feed ration was 8% body weight of fish. Highly significant ($P<0.001$) results were observed with respect to growth and body composition parameters.
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Keywords: *C. mrigala*, rice protein, rice bran, growth parameters and body composition.

1. INTRODUCTION

In current times, Fish Meal (FM) protein becomes of the most costly components in feed for aquaculture. It is thought that use of FM in future fish feed will not be affordable by the fish farmers. Presently, one of the tasks fronting the fish feed professionals is partly or entirely replace FM with cheaper protein sources and non - traditional animal or vegetables. The many studies proved a great achievement in partial substitution of FM with soybean meal and extra soybean foodstuffs in the diet of many species of fish (Hernandez *et al*., 2010)

Many differences were assessed from plant protein sources in different fish species including tilapia nutrition. But the most commonly used are sunflower meal or soybean meal, due to lesser costs, and the convenience and quality of nutrition (Jauncey and Ross, 1982). EL-Sayed (1999) found that soybean meal can replace almost 60% to 100% of fish meal without affecting the growth performance of tilapia but it depends upon the species, size of fish, protein level, source, methods and systems for culture processing. It is indicated that plant protein supplementation with specific amino acids showed limited or little importance in the growth of tilapia, as indicated by Teshima and Kanazawa (1988). (Rinchard *et al*., 2002). Cottonseed meal is one of the alternate sources that have been considered to replace animal origin protein (Mbahinzireki *et al*., 2001).

The use and handling of fish have expanded in the last twenty years, especially in the fresh and handled products of great value, due to changes in customer sense of taste and improvements in expertise, packing and carriage. In 2006, inclusion of fish as raw material in fish diet was about 20.2 million tons, indicating a reduction of 14% compared to 2005, and is still much lower than the peak of more than 30 MT in 1994 (FAO, 2008). Therefore, it is essential to study the nutritive importance of different sets of plant proteins sources to substitute fish-meal in marketable fish diets without compromising development and feed efficacy. The aim of this trail was to assess the growth, feed and configure the whole body of *C. mrigala* by using different plant sources of protein origin.

2. MATERIALS AND METHODS

Experimental diets

Six experimental diets and one controlled diet were prepared to determine the growth performance and body composition of *Cirrhinus mrigala*. Two plant protein sources with different levels were used. The plant proteins were taken from rice protein and rice bran with different levels of 30%, 35% and 40% respectively. Controlled group diet contained a balanced mixture of proteins from both the plant sources. Ingredients and proximate composition of the all experimental diets are presented in Table 1.

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Experimental design and feeding trial

Experiments were laid out in randomized complete block design and were conducted in cemented cisterns (size $2.5m^{2)}$, Institute of Pure and Applied Biology, Bahauddin Zakariya University Multan, Pakistan. Fish samples of same age group 1.5 ± 0.65 g were collected from local hatchery. The fishes were transferred to experimental laboratory in oxygen-filled polythene bags. The fries were acclimatized to experimental conditions for one week before they were removed from the reservoir tanks and transferred to cemented cisterns with circulating water system. Each cistern consisted of 10 fingerlings with a temperature $28^{o}C$, pH 7-8 and dissolved oxygen level of 5-9 mg/L maintained throughout the experiments. To keep the survival rate high, weekly monitoring of temperature, dissolved oxygen, electric conductivity (EC) and pH was carried out. If there was any variation observed in temperature, the water circulation was increased, **Table 1** which could bring down or increase the temperature to a desired level (AOAC, 1984). Similarly if pH was changed to an acid side, then lime was added into the cistern to bring the pH to a range of 7-8. Temperature and pH is maintained at a required level then EC and dissolved oxygen can be controlled (AOAC, 1984). Fish were fed twice a day by hand at 8% of body weight (Khan *et al.,* 2004) in two equal portions for 90 days. Fish feeds were adjusted after each fifteen days by randomly weighing three fish from each group.

Growth performance

To determine the growth performance, various parameters were calculated such as Body weight gain (BWG), Feed conversion ratio (FCR), Specific growth rate (SGR), Food conversion ratio (FCR), Protein efficiency ratio (PER) and Condition factor (CF). The parameters were determined as:

Body weight gain (BWG) $= \frac{\text{(Final weight-initial weight)x 100}}{\text{Initial weight}}$

Feed conversion ratio (FCR) = Wet weight gain/Dry feed intake x 100

Specific growth rate (SGR) $= \frac{\text{(Log final weight- (Log initial weight)}}{\text{No. of days fishes were reared (90 days)}} \times 100$

Food conversion ratio (FCR) = total food intake in grams/final weight-initial weight

Protein efficiency ratio (PER) = wet weight gain/protein intake

Condition factor (CF) = final weight/final $lenght^{3}$x100

Statistical Analysis

The data were analysed by ANOVA using Minitab-16. LSD was determined using Tukey's method.

Table 1Feed ingredients for feeding trail for *C. mrigala*

Ingredients (gm/kg)		Rice bran			Rice protein		
	Control	RB30	RB35	RB40	RP30	RP35	RP40
Chicken wastes	100	-	-	-	-	-	-
Mustard oil cake	100	200	200	250	-	-	200
Rice polish	100	-	-	-	-	-	-
Wheat flour	20	40	150	40	90	40	10
Fishmeal	150	-	-	-	-	-	-
Wheat bran	150	-	-	-	300	250	30
Rice bran	150	350	350	300	-	-	-
Rice protein	220	400	450	400	600	700	750
Vitamins	05	05	05	05	05	05	05
Minerals	05	05	05	05	05	05	05
Total	1000	1000	1000	1000	1000	1000	1000

RB30: Rice bran 30%, RB35: Rice bran 35%, RB40: Rice bran 40%, RP30: Rice polish 30%, RP35: Rice polish 35%, RP40: Rice polish 40%

Table 2. ANOVA Growth and body composition parameters of feeding trail for *C. mrigala*

Parameters		Rice bran			Rice protein		
	Control	**RB30**	**RB35**	**RB40**	**RP30**	**RP35**	**RP40**
Body weight gain (BWG)[1]	603.3^{a} (±114.7)	824.6^{ab} (±182.4)	966.3^{b} (±246.2)	1232.0^{c} (±222.4)	808.3^{ab} (±132.4)	700.0^{a} (±230.3)	573.3^{a} (±154.1)
Specific growth rate (SGR)[2]	2.1^{ab} (±0.16)	2.4^{bc} (±0.23)	2.6^{cd} (±0.24)	2.8^{d} (±0.19)	2.4^{bc} (±0.15)	2.2^{ab} (±0.31)	2.0^{a} (±0.25)
Feed efficiency ratio (FER)[3]	1.3^{a} (±0.18)	2.1^{b} (±0.3)	2.1^{b} (±0.4)	2.6^{c} (±0.1)	1.6^{a} (±0.3)	1.4^{a} (±0.3)	1.2^{a} (±0.1)
Protein efficiency ratio (PER)[4]	0.07^{b} (±0.01)	0.12^{d} (±0.11)	0.10^{cd} (±0.02)	0.11^{d} (±0.00)	0.09^{bc} (±0.01)	0.07^{ab} (±0.01)	0.05^{a} (±0.00)
Feed conversion ratio (FCR)[5]	78.3^{cd} (±12.2)	47.7^{ab} (±6.4)	47.7^{b} (±9.4)	38.1^{a} (±2.5)	64.1^{bc} (±13.1)	71.7^{cd} (±18.1)	82.2^{d} (±12.9)
Condition factor (CF)[6]	1.25^{c} (±0.2)	0.92^{ab} (±0.08)	0.87^{ab} (±0.08)	0.81^{a} (±0.06)	1.01^{b} (±0.1)	0.97^{ab} (±0.09)	0.87^{ab} (±0.1)
% water	82.6^{cd} (±1.5)	83.3^{cd} (±2.44)	83.2^{cd} (±3.7)	86.4^{d} (±2.1)	78.2^{ab} (±3.4)	75.6^{a} (±4.4)	80.7^{bc} (±2.9)
% Fat (Wet weight)	3.7^{ab} (±0.2)	4.36^{bc} (±0.9)	3.68^{ab} (±0.9)	2.94^{a} (±0.3)	4.53^{bc} (±0.9)	5.24^{c} (±0.9)	4.13^{b} (±0.7)
% Protein (wet weight)	13.34^{ab} (±1.3)	12.17^{ab} (±1.6)	12.95^{ab} (±2.8)	10.51^{a} (±1.8)	16.94^{cd} (±2.6)	18.44^{d} (±3.5)	14.83^{bc} (±2.4)

1-Body weight gain (%) = (Final weight– initial weight)x100/initial weight
2-Specific growth rate (%day^{-1}) = (ln final weight – ln initial weight) × 100/ days
3. Feed efficiency ratio = (Final weight– initial weight)/Total dry feed intake x 100
4-Protein efficiency ratio (g) = Final weight – Initial weight / protein intake
5. Feed conversion ratio = Total feed intake/weight gain
6. Condition factor = Final weight/Final length^{3} x 100

3. RESULTS

Highly significant ($p<0.001$) results were observed with respect to growth and body composition parameters.RB40 showed better BWG which was significantly higher from all other feeding groups. SGR was also higher in RB40 which was not significantly ($p>0.05$) different from RB35. Lowest SGR was observed in RP40. FER was good in RB40 which was significantly higher from all other feeding groups. Lowest FER was observed in RP40. PER was high in RB30 which was not significantly ($p>0.05$) different fromRB35 and RB40. Lowest PER was observed in RP40. FCR was good in RP40 which was not significantly ($p>0.05$) different from RP35 and control group. Lowest FCR was observed in RB40. Control group showed highest CF.

With respect to body composition parameters, body water content was highest in RB40 which was not significantly ($p>0.05$) different from RB35, RB35 and control groups. Fat content was high in RP30 which was not significantly ($p>0.05$) different from RP35 and RB30. Lowest fat content was observed in RB40. Protein content was highest in RP35 not significantly ($p>0.05$) different from RP30. In the meantime RB40 showed poor protein content among all feeding groups. The data on fish growth paramters and proximate analysis are shown in **Table 2** respectively.

4. DISCUSSIONS

In this study, it was observed high rate of growth and take advantage of food continuously throughout the trial for *Cirrhinus mrigala* fed with different levels of rice bran. These results are consistent with previous studies that reported in other species as a source of protein alternative such as soybean meal and cottonseed meal diet (EL-Saidy and Gaber, 1997, 2002., Coyle *et al*., 2000). 40% rice bran feed showed better growth performance and maximum feed utilization in *C. mrigala* diets in present trail.

Samocha *et al*., (2004) informed that a co-extrusion of different feed components equitable option to increase the nutritional quality of rice bran and flour a replacement when used as an ingredient in fish diets like El-Sayed (2006) observed in shrimp culture. Amaya *et al*., (2007) indicated that high levels of soybean meal in fish feed of warm water fish could the cause of the reduction of growth and take advantage of the fish feed. This is due to the high levels of fat usually listed in the diet of *C. mrigala* when using high levels of replacement (40%) of rice bran and flour in the diet. However, high levels of fat in the rice bran cause less growth, due to the high fat intolerance. Lim (2002) and Umer and Ali (2011) stated that tilapia and *Labeo rohita* did not tolerate such high-fat food as other fish (carp , trout and catfish) that use oil supplements rapidly and proficiently. Various sources of vegetable protein in tilapia were examined but little information are available in case of Indian carps. The advantage of using alternative sources of plant proteins in diets of the species *C. mrigala* not essentially lies in the composition of food, but local readiness and low costs.
This study showed that the fish that feed on plant feed had higher growth performance than the control. The results of this study are consistent with other studies (Webster *et al*., 1992a). The Nile tilapia fed diets comprising 30% fish meal and 60% soybean meal had parallel growth rate when matched with fish fed marketable diets involving fish meal (Shiau *et al*., 1990). There were no differences in weight gain in the blue tilapia, tilapia golden diets containing fish meal 30% and 74% of soybean meal diet (36 % protein) compared to fish feed containing(36 protein %) fishmeal, according to Davis and Stickney (1978). The food conversion ratio (FCR) and feed consumption differ significantly between treatments (Table 2). The amount of food and PER values similar to the values reported in Webster *et al*., (1992b). This study suggests that feed consumption was significantly different between treatments Food consumption values were similar to the values recorded in the El - Saidy and Gaber (1997). Feed consumption values tend to be higher in the fish food number 2 and 3, and this may be due to the relatively slow eating habits of Nile tilapia (Shiau, *et al*., 1990).

5. CONCLUSION

From the above experiments it is concluded that Plant had better effect on body composition and growth of fish as compared to other studies on poultry waste meal and Fish meal. Among the Rice protein and Rice Bran Rice bran is recommended for the fish as a cheaper source of protein than rice protein. In conclusion, RB40 showed better growth performance of *Cirrhinus mrigala* reared in cemented cisterns.

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