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# SUBSTITUTION OF ANIMAL PROTEIN WITH PLANT PROTEIN FED TO *Labeo rohita* AND *Cirrhinus mrigala* AND ITS EFFECT ON GROWTH AND CARCASS COMPOSITION

**Shakeela Parveen[1,]*, Iftikhar Ahmed[1], Abdul Mateen[1], Mansoor Hameed[2] and Fayyaz Rasool[3]**

**Department of Zoology and Fisheries, University of Agriculture, Faisalabad, Pakistan;**
**Department of Botany, University of Agriculture, Faisalabad, Pakistan;**
**Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore, Pakistan**
**[*]Corresponding author's e.mail: sp1165@hotmail.com**

The experiment was conducted in two replicates in four earthen fish ponds, 20-*Labeo rohita,* and 15-*Cirrhinus mrigala* were stocked in all the ponds. Various limnological parameters of water viz., temperature, pH, light penetration, dissolved oxygen, total alkalinity, carbonates, bicarbonates, total hardness, calcium, magnesium, total solids, total dissolved solids and planktonic biomass were monitored throughout the study period to keep them in suitable range for the fish production. A standard fish diet for $T_1$ was formulated having 30% crude protein using fish meal, sunflower meal, rice polish, canola meal, soybean meal and vitamin premix was also added @ 1% of the feed-weight. Experimental fish diets for $T_2$, $T_3$, and $T_4$ were prepared by replacing fish meal from standard diet with maize gluten on iso-nitrogenous basis at 25, 50 and 75% levels, respectively. The growth parameters studied for *L. rohita* and *C. mrigala* as influenced by the given experimental conditions were the increase in average body weight, fork length, total length, condition factor and total fish production. The carcass composition of fish at the end of experiment was analyzed by standard methods. From the results it was observed that highest growth was obtained from $T_1$ where standard feed was provided followed by the $T_2$ where fish meal was replaced with maize gluten at 25% level, $T_3$ when fish meal was substituted by maize gluten at 50% level and lowest was found in $T_4$ where fish meal was replaced with maize gluten at 75% level.

**Keywords:** Plant protein, Carcass, *Labeo rohita, Cirrhinus mrigala*, growth

## INTRODUCTION

To build sustainable pond fishery, it is imperative to utilize accessible regionally raised crops and animal waste as a source of protein and energy for the supply of appropriate and valuable nutrients to fish as a supplementary feed. Concoction of plant origin protein sources (corn gluten and soybean meal) were used in diets prepared for red sea bream (*S. aurata*) fingerlings as an alternate source to costly fish meal. The feeds were prepared on same level of incorporated nitrogen and crude protein 45-percent. It was found that costly fish meal can be replaced with low in cost but equally effective plant protein sources for the preparation of aquaculture feeds (Eid *et al*., 2008; Abbas *et al*., 2010; Nazish and Mateen, 2011). Major carps (*Labeo rohita, Cirrhinus mrigala* and *Catla catla*) were fed with sunflower and canola meals as fractional replacement of fish meal for the period of one year at 30% C.P. as 20, 40 and 60% levels of replacement to fish meal. All the stocked major carps performed well where standard diet was given to the stock, while in all the remaining treatments the growth was not comparable except the good growth of *C. mrigala* where the fish meal was replaced with canola seed meal at 20% level. It was concluded that fish meal can be replaced at specific rates with plant origin protein sources, which can promote the growth of specific species (Tahir *et al*., 2008). African catfish (*Clarias gariepinus*) was reared on the feeds developed by substitution of soybean flour with standard fish meal at different levels (25, 50 and 75%) to evaluate the effect of the developed feed on body weight, efficiency for consumption of feed and body composition. The growth performance of the African catfish was depressed when fish meal was substituted at higher level (75%) with the soybean flour; however, the other feed replacement levels (25 and 50%) were comparable to the standard feeds and replacement did not affected the feed efficiency (Fagbenro and Davies, 2001).

Supplementary feed containing 35% protein was applied daily at 3% of wet body weight to major carps for their body composition (Khan *et al*., 2012a). They also studied the effect of artificial diet on the culture system (Khan *et al.*, 2011) and sensory quality of fish flesh of Indian Major Carps (Khan *et al*., 2012b). Six diets with different levels (13, 26, 39, 52 and 65%) of fish meal replacement of with soybean meal were fed to Southern catfish (*Silurus meridionalis*) to sort out the best levels for replacement of fish meal with locally available sources of plant proteins (Ai and Xie, 2005). Soybean meal as a substitute to fish meal up to 20 to 50% was tested as a diet to yellow tail juveniles. The feed conversion ratio and the increase in live weight of juveniles were observed (Tomas *et al*., 2005). In another study, three earthen ponds were stocked with major carps to access the substitution of fish meal with canola meal as a low cost protein for the period of five months (Abbas *et al.,* 2006). The fingerlings of *L. rohita* were grown to test their growth in terms of increase in their body weight, feed conversion ration into flesh, efficiency for depositing protein in their body, survival rate and protein concentration deposited in muscle (Singh *et al.*, 2006). Black sea turbot were raised for sixty days to test whether the fish meal can be replaced with plant origin protein diets i.e. with soybean meal of defatted nature without any adverse impact on their survival rate and growth (Yigit *et al.*, 2010). Japanese flounder were tested for replacement of fish meal to a partial level in their diets with soybean meal in fifty six days experimental trial. Four types of feeds having 47% C.P. and 9% level with same lipid and nitrogen level were prepared by replacing fish meal with soybean meal up to 11%, 16%, 24% and 41% (Ye *et al.*, 2011).

The present experiment was planned to sort out the low cost, but effective ways of feeding fishes in semi-intensive farming system. In this study, the substitution of animal protein (fish meal) with plant protein (soya meal) were fed to *Labeo rohita* and *Cirrhinus mrigala* and the effect on growth and carcass composition was studied, to determine the level of replacement of animal origin proteins with low plant proteins.

## MATERIALS AND METHODS

The experiment was conducted in four earthen fish ponds (0.02 ha) with two replication at Fisheries Research Farms, University of Agriculture, Faisalabad (Pakistan) from 1$^{st}$ January, 2010 to 3$^{rd}$ January, 2011. Before stocking, the earthen ponds were disinfected and the pH was stabilized by liming with CaO with dusting method (Hora and Pillay, 1962). Essential precautionary measures were taken to screen the water inlets to avoid the entry of intruders or exit of fish out of ponds. After one week, each pond was watered upto 1.5 meter, which was maintained throughout the experimental period. All the fish ponds were fertilized with cow-dung @ 66.6 kg (3333.33 kg ha$^{-1}$) two weeks prior to stocking of fish. 20-*Labeo rohita,* and 15-*Cirrhinus mrigala* were stocked in all the ponds. At the time of stocking, the growth parameters such as body weight, fork length and total length of fish were measured. Various limnological characteristics of water viz., water temperature, pH, light penetration, dissolved oxygen, total alkalinity, carbonates, bicarbonates, total hardness, calcium, magnesium, total solids, total dissolved solids and planktonic biomass were monitored throughout the study period by following the standard methods of A.P.H.A. 1998.

A standard fish diet for treatment ($T_1$) was formulated having 30% crude protein using fish meal, sunflower meal, rice polish, canola meal and vitamin premix added @ 1% of the feed weight. Experimental fish diets for treatments; $T_2$, $T_3$, and $T_4$ were prepared by replacing fish meal from standard diet with maize gluten on iso-nitrogenous basis at 25, 50 and 75% levels, respectively.

**Table 1. Composition of standard and experimental diets**

| Ingredients (g/100gm) | Standard Diet | Levels of fish meal replacement with maize gluten | | |
|---|---|---|---|---|
| | | 25% | 50% | 75% |
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
| Fish meal | 24 | 18 | 12 | 06 |
| Sunflower meal | 23 | 23 | 23 | 23 |
| Rice polish | 30 | 28 | 22 | 21 |
| Canola meal | 22 | 24 | 22 | 23 |
| Maize gluten | - | 06 | 20 | 24 |
| Soybean meal | - | - | - | - |
| Vitamin premix | 1% | 1% | 1% | 1% |

After every one month, samples of cultured fish species were collected randomly by using nylon drag net from each experimental treatment and these fishes were released back into their respective ponds after recording. The data for the growth parameters viz., fish wet body weight (g), total length (cm), fork length (cm), were measured for estimation of condition factor, length weight relationship, Specific Growth Rate (SGR), Nitrogen Conversion Efficiency (NCR) and Nitrogen Incorporation Efficiency (NIE).

***Condition Factor (K)***: The value of condition factor (K) was determined by the following formula:

$$K = \frac{W \times 10^5}{L^3}$$

***Specific Growth Rate (SGR) %*: ** Dhawan and Kaur (2002)

$$SGR\ \% = \frac{\ln(FW) - \ln(IW)}{T\,Im\,eduraiton\,(days)}$$

where FW = Final wet body weight; IW = Initial wet body weight

***Length-Weight relationship*: ** LeCren (1951) as follows:

$$W = aL^b$$

***Nitrogen Conversion Ratio (NCR) by the formula*:**

$$NCR = \frac{\text{Increase in fish yield (g)}}{\text{Nitrogen added (g)}}$$

***Nitrogen Incorporation Efficiency (NIE)*: ** Mahboob and Sheri (2002).

$$NIE = \frac{\text{Amount of nitrogen (g) added}}{\text{Fish weight increment (g)}}$$

Meat quality of *Labeo rohita* and *Cirrhinus mrigala* was calculated by following, Methods of Association of Official Analytical Chemist (A.O.A.C., 2003).

***Moisture*:** Moisture (%) = $\frac{W_1 - W_2}{W_3}$

Dry matter (%) = 100 - moisture (%)

***Crude protein*:**

$$\text{Nitrogen (\%)} = \frac{\text{Volume} \times \text{Normality} \times 0.014 \times 250 \times 100}{\text{Weight of sample} \times 10}$$

where Volume = Volume of $H_2SO_4$
Normality = Normality of $H_2SO_4$

***Total fats*:**

$$\text{Total Fats (\%)} = \frac{W_2 \times W_1 * 100}{\text{Weight of sample}}$$

***Total ash*:**

$$\text{Total Ash (\%)} = \frac{\text{Weight of ash} \times 100}{\text{Weight of sample}}$$

***Carbohydrates*:**

The total carbohydrates were determined as follows:

100–(Moisture+Crude protein+Total fats+Total Ash).

The data thus obtained was subjected to statistical analysis (Steel *et al*., 1997). The variation for various parameters and the significance and their interaction among the different treatments for the growth data and various parameters were tested by using t- paired and Analysis of Variance (ANOVA) through a Micro-Computer: IBM-PC. Regression was performed to find out relationship among various attributes during this experimental period. MSTAT and MICROSTAT packages were used for the statistical analysis of the data.

## RESULTS AND DISCUSSION

The initial and final average weight was 20.38 g and 977.78 g, 20.20 g and 898.10 g, 20.34 g and 865.24 g while 20.15 g and 723.95 g; the initial and final total length was recorded 9.3 cm and 41.5 cm, 9.2 cm and 40.0 cm, 9.3 cm and 38.0 cm, 9.1 cm and 36.7 cm and the initial and final fork length was recorded 8.1 cm and 38.2 cm, 8.0 cm and 37.0 cm, 7.9 cm and 35 cm and 8.1 cm and 34.4 cm of *L. rohita* in $T_1$, $T_2$, $T_3$ and $T_4$, respectively (Table 2). In case of *C. mrigala* initial and final body weight was 17.52 g and 909.42 g, 18.11 g and 849.61 g, 17.48 g and 810.28 g, 17.33 g and 691.73 g; initial and final total length was recorded 6.8 cm and 41.1 cm, 6.9 cm and 39.3 cm, 6.6 cm and 37.3 cm while 6.5 cm and 36.0 cm and the initial and final fork length recordings were 5.3 cm and 39.4 cm, 5.4 cm and 38.5 cm, 5.2 cm and 36.0 cm while 5.1 cm and 35.4 cm in $T_1$, $T_2$, $T_3$ and $T_4$, respectively (Table 3).Analysis of variance showed that there was a highly significant difference in the increase in body weight, total length and fork length of both fishes amongst the monthly netting and under different treatments was also highly significant (Tables 2 & 3).

The condition factor for the two cultured fish species under the given experimental conditions with the provision of supplementary feed in various combinations in designated treatments as T1, T2, T3 and T4, respectively were 1.37, 1.40, 1.58 and 1.47 for *L. rohita* and 1.31, 1.39, 1.56 and 1.48 for *C. mrigala* . Analysis of variance indicated that condition factor (K) for both fishes in all ponds showed highly significant differences amongst months and treatments. The overall SGR remained as 1.06, 1.04, 1.02 and 0.98 for *L. rohita* and 1.08, 1.05, 1.04 and 1.01 for *C. mrigala* in $T_1$, $T_2$, $T_3$ and $T_4$, respectively. Analysis of variance showed that SGR % values for the both fishes in all ponds showed highly significant differences amongst the months and treatments. The correlation co-efficient for *L. rohita* was calculated as 0.981, 0.964, 0.911 and 0.975 while for *C. mrigala* it was recorded as 0.975, 0.992, 0.995 and 0.990 during the experimental period for $T_1$, $T_2$, $T_3$ and $T_4$,

**Table 2. Growth parameters of *L. rohita* from $T_1$, $T_2$, $T_3$ and $T_4$**

| Parameter | $T_1$ | $T_2$ | $T_3$ | $T_4$ | P-Values |
|---|---|---|---|---|---|
| Body weight (g) | 20.38 | 20.20 | 20.34 | 20.15 | |
| | 977.78 | 898.10 | 865.24 | 723.95 | 0.000** |
| | 957.40 | 877.90 | 844.90 | 703.80 | |
| Total length (cm) | 9.30 | 9.20 | 9.30 | 9.10 | |
| | 41.50 | 40.00 | 38.00 | 36.70 | 0.000** |
| | 32.20 | 30.80 | 28.70 | 27.60 | |
| Fork length (cm) | 8.10 | 8.00 | 7.90 | 8.10 | |
| | 38.20 | 37.00 | 35.00 | 34.40 | 0.000** |
| | 30.10 | 29.00 | 27.10 | 26.30 | |
| Condition factor | 1.37 | 1.40 | 1.58 | 1.47 | 0.0001** |
| SGR% | 1.06 | 1.04 | 1.03 | 0.98 | 0.0001** |
| Length-Weight relationship | 0.991 | 0.982 | 0.955 | 0.987 | 0.000** |
| NCR | 0.989 | 0.990 | 0.993 | 0.958 | 0.000** |
| NIE | 1.011 | 1.010 | 1.007 | 1.044 | 0.000** |

**Table 3. Growth Parameters of *C. mrigala* from $T_1$, $T_2$, $T_3$ and $T_4$**

| Parameter | $T_1$ | $T_2$ | $T_3$ | $T_4$ | P-Values |
|---|---|---|---|---|---|
| Body weight (g) | 17.52 | 18.11 | 17.48 | 17.33 | 0.000** |
| | 909.42 | 849.61 | 810.28 | 691.73 | |
| | 891.90 | 831.50 | 792.80 | 674.40 | |
| Total length (cm) | 6.80 | 6.90 | 6.60 | 6.50 | 0.000** |
| | 41.10 | 39.30 | 37.30 | 36.00 | |
| | 34.30 | 32.40 | 30.70 | 29.50 | |
| Fork length (cm) | 5.30 | 5.40 | 5.20 | 5.10 | 0.000** |
| | 39.40 | 38.50 | 36.00 | 35.40 | |
| | 34.10 | 33.10 | 30.80 | 30.30 | |
| Condition factor | 1.31 | 1.39 | 1.56 | 1.48 | 0.0001** |
| SGR% | 1.08 | 1.05 | 1.05 | 1.01 | 0.0001** |
| Length-Weight relationship | 0.988 | 0.996 | 0.997 | 0.995 | 0.000** |
| NCR | 0.989 | 0.990 | 0.993 | 0.958 | 0.000** |
| NIE | 1.011 | 1.010 | 1.007 | 1.044 | 0.000** |

respectively. The NCR and NIE values remained as 1: 0.989 and 1.011, 1: 0.990 and 1.010, 1: 0.993 and 1.007 while 1: 0.958 and 1.044 (Tables 2 & 3).

From the cost benefit analysis (Table 4) it was observed that the highest benefit was obtained from $T_1$ where standard feed was provided (Rs. 0.267million $ha^{-1}$) followed by the $T_2$ (0.247 million $ha^{-1}$) where fish meal was replaced with maize gluten at 25% level, $T_3$ (0.241 million $ha^{-1}$) when fish meal was substituted by maize gluten at 50% level and the lowest was found in $T_4$ (0.188 million $ha^{-1}$) where fish meal was replaced with maize gluten at 75% level.

In this experiment the moisture contents of *L. rohita* were ranged from 74.3, 76.3, 74.9 and 76.0 % and for *C. mrigala* were recorded as 74.07, 75.90, 76.08 and 77.63 % in $T_1$, $T_2$, $T_3$ and $T_4$, respectively. The percentage of crude protein content in *L. rohita* was found 19.8, 16.4, 16.3 and 17.8 % and *C. mrigala* showed the crude protein content of 18.65, 19.04, 17.41 and 19.24 % in $T_1$, $T_2$, $T_3$ and $T_4$ respectively. In *Labeo rohita*, total fat contents were recorded as 2.0, 3.0, 3.25 and 3.30 % while in *Cirrhinus mrigala*, total fats ranged as 1.87, 1.96, 2.01 and 2.32 % in $T_1$, $T_2$, $T_3$ and $T_4$ respectively. The ash content of *L. rohita* was recorded as 1.90, 1.93, 1.95 and 1.94 % and *C. mrigala* showed range of total ash throughout experiment as 1.64, 1.76, 1.85 and 1.98 % in $T_1$, $T_2$, $T_3$ and $T_4$, respectively. The carbohydrate percentage in the meat of *L. rohita* and the values of carbohydrates for *C. mrigala* were ranged from 1.83, 1.92, 1.99 and 2.03 % in $T_1$, $T_2$, $T_3$ and $T_4$ respectively. The statistical analysis for all the contents of cultured species showed highly significant differences among the treatments and also for the species (Table 5).

**Discussion:** The highest growth was obtained from $T_1$ where standard feed was provided followed by the $T_2$ where fish meal was replaced with maize gluten at 25% level, $T_3$ when fish meal was substituted by maize gluten at 50% level and the lowest was found in $T_4$ where fish meal was replaced with maize gluten at 75% level. Highly significant differences were found between treatments for the average increase in body weight, total length and fork length for the both cultured species viz., *L. rohita* and *C. mrigala*. The substitution of maize gluten with fish meal in the standard diet showed pronounced effects on the growth parameters; however, as the substitution level increases the growth decreases for both fishes. These results are in accordance with reviewed work of Fagbenro and Davies (2001) that fish meal can be replaced with plant proteins upto 50% without any negative impacts on growth of the fish and Chou *et al.* (2004) who suggested that good effects were observed on growth by feeding fish with feeds upto 50% replacement of fish meal with plant origin feed sources meal from the mixture. These results also correlates with the findings of Abbas *et al.* (2006) On the other hand, the substitution of plant origin proteins to fish meal in diets of commercially important fishes can decrease the cost of diet and make this business more profitable is comparable with Eid *et al.* (2008), who tested plant protein sources as replacement to fish meal showed remarkable decrease in costs of feed when fish was fed with replaced diets without any negative impact on growth of fish. This study showed that costly fish meal can be replaced with low in cost but equally effective plant protein sources for the preparation of aquaculture feeds when included in the ratios of at least 50%. The level of replacement and economically this study also supported the results of El-Saidy and Gaber (2008), which showed that fish meal can be replaced with plant protein upto higher levels (55%) can decrease the feed costs and increase the income from the fish production in terms of increase in yield. The results of our study clearly suggest that by replacing fish meal with maize gluten and soybean meal, as percentage of maize gluten and soybean meal replaced with fish meal increase from 25%-50% the growth increases positively and the cost benefit analysis indicates that the feed cost decreased by replacing more and more fish meal with maize gluten and soybean meal. The study is supported by results of Ogunji and Wirth (2001) research on tilapia

**Table 4. Production from $T_1$, $T_2$, $T_3$ and $T_4$ and Cost Benefit Analysis**

| Treatments | Standard Diet | | Levels of Fish Meal Replacement with Maize Gluten Meal | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $T_1$ | | $T_2$ | | $T_3$ | | $T_4$ | |
| **Stocked species** | ***Rohu*** | ***Mori*** | ***Rohu*** | ***Mori*** | ***Rohu*** | ***Mori*** | ***Rohu*** | ***Mori*** |
| No. of Stocked Fish Pond$^{-1}$ | 20 | 15 | 20 | 15 | 20 | 15 | 20 | 15 |
| No. of Harvested Fish Pond$^{-1}$ | 20 | 15 | 20 | 15 | 20 | 15 | 20 | 15 |
| Initial weight (g) individual$^{-1}$ | 20.38 | 17.52 | 20.20 | 18.11 | 20.34 | 17.48 | 20.15 | 17.33 |
| Total Initial Weight (g) of Both Spp. Pond$^{-1}$ | 407.60 | 262.80 | 404.00 | 271.65 | 406.80 | 262.20 | 403.00 | 259.50 |
| Final weight (g) individual$^{-1}$ | 977.78 | 909.42 | 898.10 | 849.61 | 865.24 | 810.28 | 723.95 | 691.73 |
| Gross Fish Production (kg) Pond$^{-1}$ | 33.196 | | 30.706 | | 29.458 | | 24.854 | |
| Gross Fish Production (kg) Acre$^{-1}$ | 675.21 | | 621.58 | | 596.31 | | 503.11 | |
| Gross Fish Production (kg) Hectare$^{-1}$ | 1659.80 | | 1535.30 | | 1472.90 | | 1242.70 | |
| Total Income (Rs.) from fish Sale Hectare$^{-1}$ | 580930 | | 537355 | | 515515 | | 0.435 M | |
| Total Added Supplementary Feed Pond$^{-1}$ (Kg) | 109.5916 | | 101.1065 | | 96.6657 | | 84.26607 | |
| Total Needed Supplementary Feed Acre$^{-1}$ (Kg) | 2218.453 | | 2022.13 | | 1933.314 | | 1685.321 | |
| Total Needed Supplementary Feed Hectare$^{-1}$ (Kg) | 5479.58 | | 5055.325 | | 4833.285 | | 4213.304 | |
| Total Cost of Needed Feed Hectare$^{-1}$ (Rs.) | 216991 | | 193619 | | 177865 | | 0.150 M | |
| Total Cost of Seed Purchased @ Rs. 1 Inch$^{-1}$ | 7000 | | 7000 | | 7000 | | 0.007 M | |
| Total Electricity Bill of Turbine Feeding Water to 1-Hectare | 90000 | | 90000 | | 90000 | | 0.090 M | |
| Total Expenditure Hectare$^{-1}$ (Rs.) | 313991 | | 290619 | | 274865 | | 0.250 M | |
| Total Benefit Hectare$^{-1}$ (Rs.) | 266939 | | 246736 | | 240650 | | 0.188 M | |

Rohu = *Labeo rohita*, Mori = *Cirrhinus mrigala and M = Million*

**Table 5. Carcass composition of *L. rohita* and *C. mrigala* in $T_1$, $T_2$, $T_3$ and $T_4$**

| Levels | | Std. diet | 25% | 50% | 75% | P-Values |
|---|---|---|---|---|---|---|
| **Treatments** | | $T_1$ | $T_2$ | $T_3$ | $T_4$ | |
| *L. rohita* | Moisture% | 76.30 | 74.90 | 74.30 | 76.00 | <0.0001 |
| | Crude Protein% | 16.40 | 16.30 | 19.80 | 17.80 | <0.0001 |
| | Fats% | 3.00 | 3.25 | 2.00 | 3.30 | <0.0001 |
| | Ash% | 1.93 | 1.95 | 1.90 | 1.94 | <0.0001 |
| | Carbohydrates% | 2.37 | 2.10 | 2.00 | 2.41 | <0.0001 |
| *C. mrigala* | Moisture% | 75.90 | 76.08 | 74.07 | 77.63 | <0.0001 |
| | Crude Protein% | 19.04 | 17.41 | 18.65 | 19.24 | <0.0001 |
| | Fats% | 1.96 | 2.01 | 1.87 | 2.32 | <0.0001 |
| | Ash% | 1.76 | 1.85 | 1.64 | 1.98 | <0.0001 |
| | Carbohydrates% | 1.92 | 1.99 | 1.83 | 2.03 | <0.0001 |

fingerlings that can grow rapidly with replacement of fishmeal with soybean meal upto 25% level. Tomas *et al.* (2005) also noted that when soybean meal was replaced with fish meal at higher levels (40 & 50%) showed negative results in terms of growth as compared to lower levels (20 & 30%), where the yellow tail juveniles showed better growth as fed with fish meal and showed best conversion ratio. In the work of the Wang *et al.* (2006) with cuneate drum it was also observed that with increase in level of soybean the fish weight decreased linearly. Gain in weight was not considerably different between control and upto 20% replacement levels but as replacement increases increase in body weight decreased. This study also confirmed the results of Tahir *et al.* (2008) that major carps performed well in where standard diet was given to the stock, except the good growth of *C. mrigala* in the pond where the fish meal was replaced with canola seed meal at 20% level.

The results of present study are supported by the results ranges near to one 0.925-0.999 by Mahboob and Sheri (1999) for major carps under the influence of different treatments of supplementary feeds. This study also showed that the growth tends to be isometric in nature which is in accordance with results confirmed by Naeem *et al.* (2010) who proved that a tendency for regression coefficient (b) in the relation $W = aL^b$ to be close to or greater than similar figure for hybrid, *Catla catla* ♂ X *Labeo rohita* ♀, also by Naeem and Salam (2005) and Chaudhuri (1973) and Tahir *et al.* (2008) who conducted study with major carps in seven earthen ponds and concluded that length-weight relationship of three major carps gave isometric growth patterns.

The overall SGR of *L. rohita* remained as 1.06, 1.04, 1.02 and 0.98 in $T_1$, $T_2$, $T_3$ and $T_4$, respectively. The overall SGR of *C. mrigala* remained as 1.08, 1.05, 1.04 and 1.01 in $T_1$, $T_2$, $T_3$ and $T_4$, respectively. Statistical results values showed the similar trends in specific growth rate of *L. rohita* and *C. mrigala* in all the treatments. From these results it is clear that there is remarkable difference in SGR between the experimental and control ponds which is in accordance with the studies of El-Saidy and Gaber (2008), who concluded the same results with Nile tilapia. These results are also similar with Hossain and Jauncey (2008) who worked with *Cyprinus carpio* and postulated the results that better SGR was observed for the said specie by replacing fish meal with oil seed proteins.

The *L. rohita* and *C. mrigala* were also analyzed statistically for body composition from the treatments $T_1$-$T_4$ where the fish meal was replaced with maize gluten and results obtained showed highly significant differences among the treatments and also for the species for different parameters viz., moisture contents, protein contents, total fat contents and also for carbohydrates contents while these differences were non-significant in case of total ash among the treatments and also among the species. This showed that being the low crude protein (30%) in the maize gluten as substitute to fish meal the differences were highly significant. The results suggested that the inclusion of the plant source protein mixture as substitute to fish meal not affect considerably the dry matter of the whole fish body, protein extracts from the fish body, fat contents of the fish and also the energy incorporated in fish in comparison to control diets and is comparable with El-Saidy and Gaber (2003). These results are also in accordance with studies of El-Saidy and Gaber (2008), the body composition of cultured species showed not any considerable difference among all the treatments but protein contents of the different treatments showed major variability from the standard diet. This study clearly advocates the idea that fish meal can be replaced with plant proteins up to higher levels as much as possible and devoid of any unpleasant consequences for body composition of fish. Kikuchi (2008) while working with juvenile Japanese flounder suggested similar to this study postulated that whole body composition of the cultured fish is not considerably effected among the treatment so it is implied that fish meal protein can be substituted with plant protein sources meal in the diet of major carps. .

***Conclusion*:** The results showed that highest growth was obtained from $T_1$ where standard feed was provided followed by the $T_2$ where fish meal was replaced with maize gluten at 25% level, $T_3$ when fish meal was substituted by maize gluten at 50% level and lowest was found in $T_4$ where fish meal was replaced with maize gluten at 75% level. This study proved that fish meal can be replaced only at specific rates with soybean meal protein sources.

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