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INFLUENCE OF DIFFERENT LEVELS OF PROTEIN ON GROWfH PERFORMANCE AND BODY COMPOSITION OF MAJOR CARPS

Shahida Parveen & Ahmad Nadeem Sheri
Department of Zoology,
University of Agriculture, Falsalabad.

The present study was conducted to measure the growth in terms of weight and length of different species of fish and to determine the proximate composition of fish at the final harvest. The effect of supplementation of three protein mixtures containing 40, 45 and 50% crude protein was determined. The results showed significant differences among weights of fishes raised under different crude protein levels of supplemental mixtures. The three fish species showed the best growth of fish in control group, which was comparatively better than with other two levels of crude protein. Body moisture and crude protein contents of fishes given mixtures containing 40% crude protein level remained the highest. However, fat content was highest in control. There existed inverse relationship between protein and fat contents of fish while direct relationship was found between body moisture and crude protein contents.

INTRODUCTION

The primary objective of fish husbandry is to produce fish flesh having over 50% protein on dry weight basis (Piper *et al.;* 1982), In commercial fish farming it is desirable to establish a minimum protein level for protein supplements that would produce maximum growth when added to water body. Studies have shown that the nutritional requirements of common carp can be satisfied by the diet containing 36 to 40% crude protein besides being rich in energy. Cowey (1975) found that 40% crude protein level would cover most species. The present study deals with the influence of different levels of crude protein in supplemental mixtures on growth performance and body composition of major carps. The study was conducted to achieve the following objectives:

1. To measure the growth in terms of weight and length of different species of fish.
2. To determine the proximate composition of fish at the final harvest.

MATERIALS AND METHODS

Culture system: The experiment was conducted at Fisheries Research Farms, Department of Zoology, University of Agriculture, Faisalabad. The culture system consisted of four earthen ponds, each measuring 22 x 7.5 x 1.8 m and was supplied with tubewell water. All the ponds were sun dried for a period of one month. To disinfect the ponds and to stabilize the pH of water, liming was done with CaOat the rate of 200 kg/ha by dusting method. The inlets of all these ponds were properly screened to avoid the entry of any intruder into 'or exit of fish from ponds. All the ponds were initially filled with unchlorinated tubewell water up to a level of 1.50 m and this level was maintained throughout the experimental period. The interspecies ratio was adopted

Labeo rohita, cirrhinus mrigala and *Catla catla,* respectively. Fingerlings of the three species of fish were collected from cemented ponds and each earthen pond was stocked with 64 fishes.

One pond was kept as unsupplemented control and other three ponds were supplemented with different protein mixtures. Three protein mixtures containing 40, 45 and 50% crude protein were formulated using different proportions of blood meal, meat meal, wheat bran, rice polish, rice broken, cottonsccd cake, cottonseed meal, maize gluten, soybcan oil meal, guar meal, fish meal and molasses. On second day after stocking, experimental ponds were supplemented with different protein mixtures at the rate of 2% of total wet body weight (Shell, 1967). The supplementation was continued for a period of nine months.

Growth studies: The cultured fish stock was randomly sampled with the help of nylon drag nets from each of the pond under study. The morphometric characteristics of fish such as wet body weight, fork and total lengths were recorded to observe their growth performance under different levels of crude protein supplementation. After obtaining the desired data, fish were released back into their respective ponds.

Meat studies: Fish meat was analysed at the end of the experiment. Five fish of each species from each of the pond were randomly selected and four meat samples were drawn from each specimen. The moisture, crude protein, ether extract and ash contents were analysed following AOAC (1984) methods.

RESULTS AND DISCUSSION

The average body weight, fork length and total length of fishes of different species have been shown in Table 1.

A. Growth performance

Body weight: The results showed significant differences among weights of fish raised in pounds supplemented with mixtures containing different crude protein levels. The interaction between levels of crude protein and species for final weight was significant. The comparison of means revealed that in *Labeo rohita* there were significantly higher weights at 40% crude protein level than with other levels of protein and control. The weight was significantly depressed at 45 and further at 50% crude protein levels than with 40% level and control. Similar trend was observed in case of *Catla catla* out in case of *Cirrhinus mrigala* nonsignificant differences were observed in weight of fish raised under 45% crude protein level and control. Nonsignificant differences were also observed in weights of fishes raised under 45 and 50% levels of crude protein. A gradual increase in weight of the three fish species was observed from January to March and subsequently a sharp increase in weight was observed till the attainment of the highest weight in July under all the four treatments. During this month the temperature was the highest. However, there was a sharp decline in body weight gain thereafter. It could be due to sudden decrease in water temperature during the months of August and September. In all the three fish species minimum and maximum gain in weight was observed with 50 and 40% crude protein levels, respectively. Performance of three fish species for their final average body weights raised under different levels of crude protein in supplemental mixtures revealed that among all the three fish species *Catla catla* was the fastest growing fish.

Lengths: Significant differences were observed due to type of fish and the levels of crude protein. The interaction between levels and species for final fork and total lengths was nonsignificant. Both fork and total lengths in all the three fish species were significantly higher with 40% crude protein level than with others. Next in order were fork and total lengths of control which was significantly higher than that of those raised at 45 and 50% crude protein levels. In case of *Labeo rohita* and *Cirrhinus mrigala* the highest growth was obtained with some annual fluctuation except *Catla catla,* where gradual increase in the fork length and total length was observed from January to March, after which, in all the three fish species comparatively greater increase in length was observed till the highest growth in July. The three fish species showed maximum growth with 40% crude protein level.

Table 1. Average body weight, fork length and total length of fishes of different species raised on different levels of crude protein in supplemental mixtures.

Species	Levels of crude protein (%) 40	45	50	Control	Averages
		Weight			
Labeo rohita	413.69E	295.52G	226.70 III	368.40 F	326.18
Cirrhinus mrigala	328.30G	225.00III	191.00 I	258.80II	251.0 C
Catla catla	1410.00A	788.00C	625.00D	1210.00 D	1008.0A
Averages	717.3A	436.2C	347.6D	612.7 D	
		Frok length			
Labeo rohita	269.0	194.0	180.0	230.0	218.3B
Ci"hiJIIIS mrigala	247.0	167.0	147.0	198.0	189.8C
Cata Catla	365.0	267.0	293.0	321.0	298.0A
Averages	293.7A	209.3C	188.7D	249.7 B	
		Total length			
Labeo rohita	340.0	245.0	239.0	29(H)	278.5B
Cirrhill us mrigala	307.0	216.0	208.0	265.0	249.0C
Catla catla	464.0	367.0	336.0	411.0	394.5A
Averages	370.3A	276.0C	261.0C	322.0 B	

The same superscripts on means in a coloumn show nonsignificant differences.

Length weight relationship: Regression equations were fitted for length and weight for all the three fish species given different treatment. The regression equations for the total lengths and fish weight, fork lengths and fish weight, fork lengths and total lengths were also worked out separately for each fish species as influenced by different levels of crude protein. The regression lines showed the linear relationship between log of fish length and weight.

Feed conversion ratios were calculated for three fish species raised using 40, 45 and 50% crude protein levels of supplemental mixtures. The best feed conversion ratio was obtained with 40%

crude protein level. When the three fish species given four different treatments were compared, *Catla catla* showed the best feed conversion ration followed by *Labeo rohita* and *Cirrhinus mrigala.* These findings are in conformity with Hepher and Chervinski (1%5) who concluded that considerable gain in carp fish yield can be obtained by the use of protein rich diet. The overall feed conversion rations were calculated as 1.44, 1.56 and 1.58 for the three crude protein levels, respectively. The conversion of feed to fish flesh calculated by Javed (1984) was 2.82:1 which is better than results (3.30:1) of Chakrabarty (1973). In present study feed conversion ratio for major carps was found to be 1.44:1 in 40% crude protein level, which is inturn much better than the above workers.

In the present study, the higher growth rate of *Catla catla, Labco roliita* and *cirrhinus mrigala* was obtained by feeding 40% crude protein in water body. These findings showed that 40% crude protein level was suitable for the major carps under a polyculture system. Chakrabarty and other (1976) pointed out that *Catla catla* was the fastest growing fish. Depressed growth rate was however, observed in fish raised on 45 and 50% crude protein levels.

Growth depression has been reported when the level of dietary protein mixtures exceeded a certain limit in rainbow trout (Zeitoun *et al.,* 1973) Similar results were observed by Santiago *et al.* (1982) for *Tilapia mossambica.* They also concluded that fish growth was not affected significantly with minor variations above a certain optimal value. Beaton (1964) pointed out that high protein diets placed an abvious load on the kidney and increased water requirements.

Maximum increase in body weight of the three fish species in treated and control ponds was observed during the month of July, indicating their temperature performance ranges. Minimum increase in weight, fork and total lengths in four ponds was observed during the months of January and February. The decreased growth rate in fish weight, fork and total length of fishes during the months of January and February could be due to decreased temperature values, which lowered the fish metabolism and feeding activities. Black (1955) also stated that standard fish methabolism increased persistently with an increase in temperature till it reached lethal temperature limits which ultimately affect the feeding rate. Increase in fork and total length with small annual fluctuations was observed to be in accordance with those obtained by Rashied (1985) who reported high increase in fork and total length of fish during warmer months as compared to the increase in colder months. Similar results have been reported by Salecm (1988).

R. Proximate composition: Moisture, crude protein, ether extract and ash contents of fish meat were analysed at the end of the experiment. Body moisture and crude protein content of the fish decreased with the increase of crude protein level of supplemental mixtures. The highest moisture and crude protein contents were observed in the fishes raised under 40% crude protein level. However, in control, the moisture and crude protein content were greater than with other two crude protein levels. The fat content of the fishes increased with increase of crude protein level. However, the highest fat content was observed in fishes raised under control. An inverse relationship was found between crude protein and fat content of fish meat, while directrclationship was observed between moisture content and crude protein content. No such relationship was observed in the ash content of the fish species (Table 2).

Proximate composition of meat varies

considerably from species to species. In the present study significant differences existed among all the three fish species with respect to proximate composition. The highest crude protein was found in *Labeo rohita* followed by *Cirrhinus mrigala* and *Catla catla.* Stansby (1962) reported marked species vanaties. He also observed an apparent inverse

Table 2. Average proximate composition of different types of fish raised on different levels or crude protein.

Species	Protein levels Control	40	45	50
		Body moisture (%)		
Labeo rohita	b 74.77 ± 0,59	a 76.73 ± 1.10	b 73.65 ± 0.61	c 71,05 ± 0.86
Cirrhinus mrigala	b 71.20 ± 0.86	a 73,41 ± 0.86	bc 70.56 ± 0,58	c 69.54 ± 0,47
Catla catla	b 68.46 ± 0.35	a 70,40 ± 0,45	b 67.59 ± 0.61	c 64.90 ± 1,46
		Crude protein (%)		
Labeo rohita	c 53.77 ± 0.81	a 60,42 ± 0.96	b 56.26 ± 0.88	c 53.68 ± 0.81
Cirrhinus mrigala	b 54.25 ± 0.31	a 56,57 ± 0.63	b 53.51 ± 0,53	c 51,10 ± 0.40
Catla catla	b 51,62 ± 0,50	a *53.16* ± 0,49	b 51,06 ± 0,41	c 48.74 ± 0,47
		Ether extract (%)		
Labeo orhita	a 30.75 ± 0,41	cl 21,79 ± 0,53	c 23.20 ± 0.26	b 27.25 ± 0,50
Cirrhlnus mrigala	a 32.86 ± 0.39	d 24.75 ± 0.74	c 26,15 ± 0,52	b 29.08 ± 0.40
Catla Catla	a 34.72 ± 0,37	d 26.60 ± 0.38	c 29,43 ± 0.33	b 33,59 ± 0.29
		Ash (%)		
Labeo rohita	*d* 8,50 ± 0.03	*b* 9.08 ± 0.02	*a* 9.21 ± 0.0r	*c* 8.62 ± 0.03
Cirrhinus mrigala	d 9.28 ± 0.03	b 9.80 ± 0.03	a 10.08 ± 0.03	c 9.63 ± 0.02
Catla catla	a 8.80 ± 0.03	b 8.70 ± 0.03	b 8.65 ± 0.06	a 8.95 ± 0.01

The means in a column having the same superscripts are not significantly different.

He also observed an apparent inverse relationship between the lipid and moisture contents of fish. Similar inverse relationship was found in the present study.

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