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Growth Performance, Length-Weight Relationship, Body Condition and Carcass Composition of *Cyprinus carpio* Fed with Poultry Dropping Incorporated Diets

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Abstract: *Fifty fingerlings of common carp, Cyprinus carpio were stocked in each of four rectangular tanks. The formulated fish feed comprised of deoiled groundnut cake, rice polish, poultry dropping and vitamin-mineral feed supplement. The fishes in the tank T1 were fed with control diet D1 (0% poultry dropping) and the fishes in tanks T2, T3 and T4 were fed with test diets D2 (10% poultry dropping), D3 (15% poultry dropping) and D4 (20% poultry dropping), respectively. All diets contained around 30% protein. The fishes were fed @ 5% of total body weight/day in two equal installments, one in the forenoon and other in late afternoon. Fishes were sampled fortnightly. Water quality parameters were monitored regularly. Highest specific growth rate (0.26%/day) was recorded in tank T2 where fishes were fed with 10% poultry dropping incorporated diet. The experimental fishes recorded the value of exponent 'n' in the range of 3.37 to 3.57, coefficient of correlation 'r' in the range of 0.9938 to 0.9987 and coefficient of determination 'r2' from 0.9876 to 0.9974. More than 98% of experimental fishes departed from cube law of length-weight relationship towards higher side. The Condition Factor 'K' from 1.94 to 2.0 of experimental fishes indicated the well being and good condition of fishes. The analysis of muscle composition of fishes revealed that the protein content in muscle increased with the increasing amount of incorporated poultry dropping in fish feed.*

Keywords: Specific growth rate, Condition factor, Formulated feed, Isometric growth.

Introduction

The success of composite culture of carps rests upon suitable species, good quality seed and appropriate supplementary feed. Expenditure on artificial feed alone accounts for over 40-45% of the total operational cost in semi intensive culture of carps. Chicken dropping has feed and fertilizer value. The increase in intensive rearing of poultry has resulted in considerable production of poultry dropping. The estimated 2010 world flock was over 18 billion birds with a yearly manure output of 22 million tones (FAO 2010). Recently increased attention has been paid to the use of it as a fertilizer and feedstuff for animals. Dried poultry dropping is good source of protein and minerals. Dried poultry manure contains sufficient levels of digestible energy, crude fibre, crude protein, crude fat, cobalt and iodine (Ghaly and MacDonald, 2012). Sharma *et al*., (1987) studied the biological performance of some organic and inorganic feeds on the common carp fingerlings growing under sub mountain region of Himachal Pradesh. Devaraj *et al*., (1988) tried poultry dropping based feed prepared by using 50% dried poultry faecal matter, 25% rice bran and 25% groundnut cake to compare the efficiency of poultry dropping based feed against conventional feed under composite fish culture system stocked with fingerlings of catla, rohu, mrigal and common carp. The condition factor in different cyprinids has been worked out by Pathak (1975), Pathani and Das (1980)

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and Yousuf and Pandit (1989). In the present study an attempt has been made to incorporate poultry dropping into formulated feed for common carp, *Cyprinus carpio*, raised in mildly flowing water condition, and to analyze the health status of fish fed with poultry dropping based artificial diets.

Materials and Methods

The study was carried out in four outdoor cemented rectangular tanks of the size of 8.0x1.25x0.85 m. The water depth of 0.70 m was maintained throughout the study period (150 days). The flow of 25 l water/minute was maintained in all the tanks during 6.00 to 10.00 am, 12.00 noon to 3.00 pm and 5.00 to 9.00 pm daily. The first tank (T_1) was used as control while other three (T_2, T_3 and T_4) were used for different formulated test diets. Each tank was stocked with 50 numbers of measured and weighed fingerlings of common carp*, Cyprinus carpio*. Water temperature, pH and dissolved oxygen in tank water were regularly recorded and monitored. The experimental ponds were drained, cleaned and washed with lime water every fortnight to get rid of algal growth and microbes in tanks.

The artificial feed comprised of deoiled groundnut cake, rice polish, poultry dropping/ excreta and commercial mineral-vitamin feed supplement. The proximate analysis of feed ingredients and test diets was carried out as per procedure of AOAC (2000). Dried poultry excreta was incorporated into fish diets at the rate of 0 % (D_1, control diet), 10% (D_2), 15% (D_3) and 20% (D_4). The pelletized experimental diets were fed to fishes @ 5% of fish body weight/day. The feed was given twice a day in two equal installments, one in forenoon around 9 AM and the other during afternoon around 4 PM. Sampling of fish for growth and health monitoring was done at fortnightly intervals. Specific growth rate (SGR) of fish was assessed by the formula-

$$SGR = \frac{\ln \text{final weight} - \ln \text{initial weight}}{\text{Time (in days)}} \times 100$$

The length weight relationship of the experimental fishes is worked out as per cube law given by Le Cren (1951) as below-

$$W = CL^3$$

Where, W = weight of fish in g
L = length of fish in cm
C = constant factor

The logarithmic transformation of above formula is-

$$\log W = \log a + n \log L$$

The condition factor (K) of the fishes is calculated as per formula given below-

$$K = \frac{W}{L^3} \times 100$$

Where, W = weight of fish (g)
L = length of fish (cm)

Fish muscles were analyzed for proximate composition as per procedure of AOAC (2000).

Results and Discussion

Physico-chemical profile of water

The profile of water temperature, pH and dissolved oxygen in experimented ponds has been presented in Fig 1. The water temperature during study period ranged between 16.0 and 21.2^{o}C. The pH of water in experimental tanks remained slightly or mildly alkaline throughout the experimental period barring four weeks when pH went little below 7.0. Amount of dissolved oxygen in water remained sufficiently above normal limit of 5 mg/l, as suggested by Chauhan (2001). The analysis of variance revealed that differences in water temperature, pH and dissolved oxygen in four experimental tanks were not significant.

Feed composition

The composition of feeds used and proximate analysis of control and test diets have been presented in Tables 1 and 2, respectively. Authors like Devaraj *et al.,* (1988), Jantrarotai and Boonman (1996), Abdelghany *et al.,*

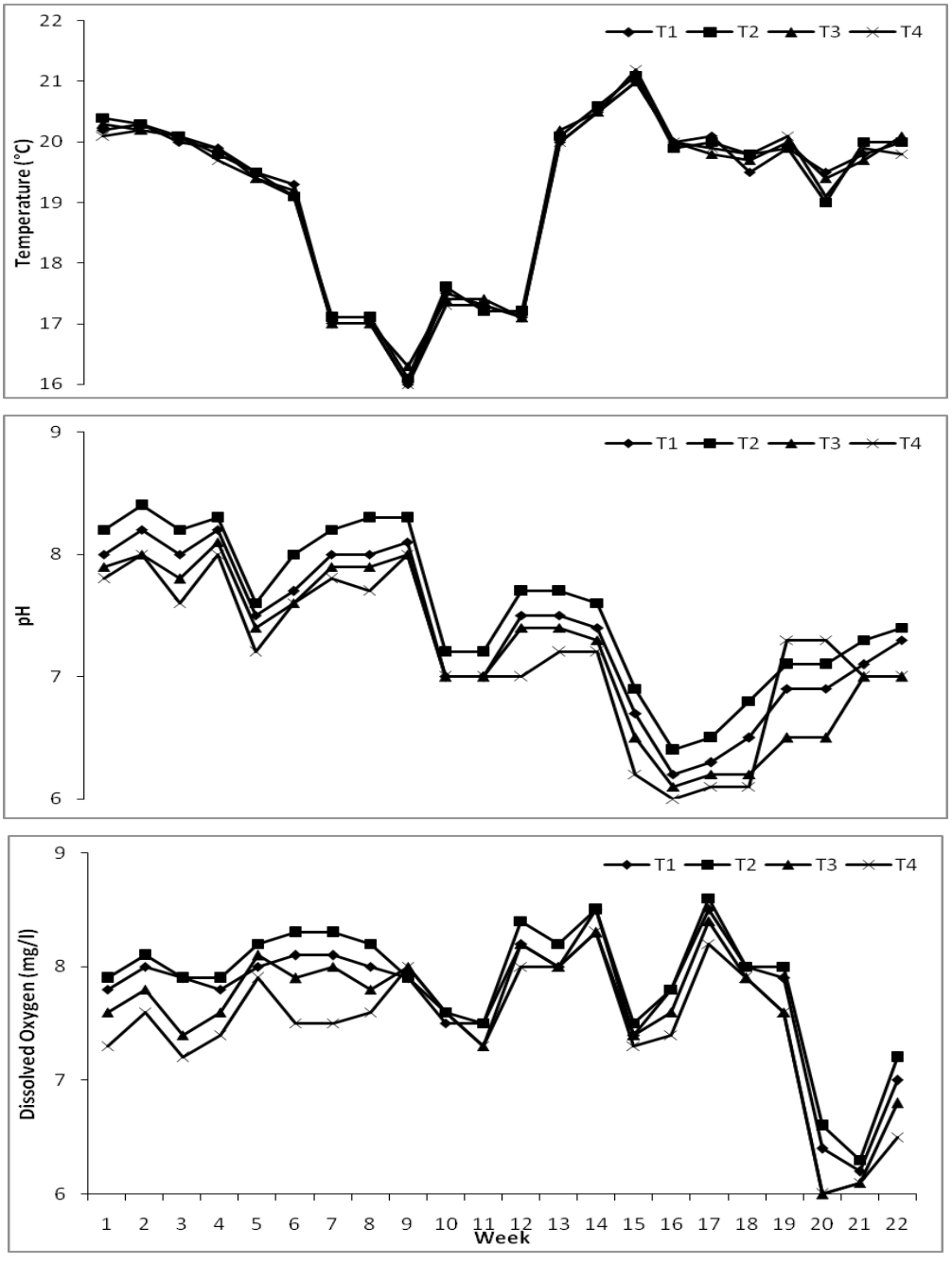

Fig. 1. Pattern of variation of water temperature, pH and dissolved oxygen in experimental tanks $T_1 – T_4$.

(1997), Saha and Ray (1998) and Nwanna (2002) substituted poultry waste in the form of litter, manure or dropping at the rates ranging from 10 to 50% in formulated feeds for different freshwater fishes including common carp. The crude protein content in poultry dropping was 24.2% (dry matter basis) which is much higher than rice polish (13.2%). Obasa *et al.,* (2009) sundried poultry manure for use as fish feed of African catfish (*Clarias gariepinus*) and reported

Table 1 Composition of feed used in experimental tanks.

Ingredients	Control diet (D_1)	Test diet I (D_2)	Test diet II (D_3)	Test diet III (D_4)
Deoiled groundnut cake	56.55	53.02	51.26	49.49
Rice polish	37.45	30.98	27.74	24.51
Poultry dropping	0.00	10.00	15.00	20.00
Starch	5.00	5.00	5.00	5.00
Mineral vitamin mixture	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00

Table 2 Proximate analysis of the control and test diets fed to common carp.

Content	D_1	D_2	D_3	D_4
Crude protein (%)	29.97	29.99	30.10	30.15
Lipid (%)	5.84	5.87	6.02	5.92
Moisture (%)	6.57	10.54	11.03	11.98

Table 3 Details of growth, harvesting and production of Cyprinus carpio in experimental Tanks.

Details	Tank			
	T_1	T_2	T_3	T_4
No. of fish stocked	50.00	50.00	50.00	50.00
No. of fish harvested	50.00	50.00	50.00	50.00
Survival (%)	100.00	100.00	100.00	100.00
Initial average weight (g)	9.20	8.90	9.00	9.10
Final average weight (g)	20.40	21.70	19.80	18.90
Total weight stocked (g)	460.00	445.00	450.00	455.00
Total weight harvested (g)	1020.00	1085.00	990.00	945.00
Gross production in tank (g)	560.00	640.00	540.00	490.00
Specific Growth Rate (%/day)	0.23	0.26	0.23	0.21

a protein content of 28.6%. The crude protein content in experimental diets made for present study was near to 30% (29.97 - 30.15%). The protein contents in poultry manure meal based diets prepared by Abdelghany *et al.,* (1997) fed to blue tilapia, *Oreochromis aureus*, ranged from 29.91-30.14%. Saha and Ray (1998) prepared poultry litter based test diets having 33.30-35.95% crude protein for rohu (*Labeo rohita*) fingerlings.

Growth and Production

The data on survival, growth and production has been included in Table 3. The highest specific growth rate was recorded in Tank 2 (T_2) where the fishes were fed with the diet containing 10% poultry dropping in it. The differences in the harvested weights from different tanks were significant (Table 4). It is clear from the results that the growth rate decreased at

Table 4 Analysis of variance (ANOVA) of weight at the time of harvesting of common carp from experimental tanks.

Source of variation	df	ss	Ms	F-value
Treatment	3.00	207.00	69.00	3.1197 s
Error	196.00	4335.00	22.1173	
Total	199.00	4542.00		

higher level of incorporation of poultry dropping in test diets. Abdelghany *et al.,* (1997) incorporated poultry manure up to 20% to replace soybean meal from fish feed for blue tilapia. Saha and Ray (1998) recorded best specific growth rate in *Labeo rohita* fed with 20% poultry litter incorporated diet than the control one. It can be inferred from the results of present study that 10% dried poultry dropping can be incorporated as an ingredient in feed for common carp without affecting growth rate and survival of the fish.

Length-weight Relationship

The length-weight relationship was computed from data collected throughout the study period. The equations obtained are shown in Table 5. The values of regression coefficient 'n' (3.37 to 3.57) are in agreement with the studies of Otubusin (1990), Sarkar *et al.,*(1998) and Mitra *et al.,*(2005) who recorded the values of 'n' from 2.53 to 3.41. Ebanaser and Jayaprakas (2005) recorded the value of 'n' around 3 in *Channa micropeltis.* The value of 'n' exponent significantly greater than 3 or less than 3 denoted that the fish did not maintain the isometric pattern of growth. This means that if the exponent is less than 3, the species becomes lighter for its length as it grows larger and if greater than 3, the species becomes heavier for its length as it grows longer. In the present study, common carp recorded the value of 'n' ranging from 3.37 to 3.57 in all experimental tanks i.e. more than 3. Thus, the results of the present study are in conformity with the views of Le Cren (1951) and Chauhan (1987) that as the fishes normally do not retain the same shape or body outline throughout their lifespan and specific gravity of tissues may not remain constant, the actual relationship may depart significantly from the cube law. The perusal of coefficients of correlation and determination revealed that more than 98% of the experimental fishes departed from the cube law length-weight relationship towards higher side.

Condition Factor

The values of condition factor 'K' for the fishes stocked in experimental tanks are listed in Table 6. Various workers have calculated the Ponderal Index or condition factor of different fishes viz. 0.73-0.95 in *Tor putitora* (Pathani and Das, 1980), 1.03-1.31 in *Salmo trutta fario* (Kumar *et al*., 1979), 0.96-1.03 in *Oreochromis mossambicus* (Shendge, 2005) and 0.85-1.10 in *Gadusia chapra* (Masud and Singh, 2011). Kumar *et al.,* (1979) concluded that a fish recording the value of condition factor as about 1.0 is considered to be of its average weight. This factor is indicator of the robustness or well being of fish. The values recorded in the present study are in range

Table 5 Length-weight relationship of common carp reared in experimental tanks.

Tank	Logarithmic equations	Correlation Coefficient (r)	Coefficient of Determination (r^2)
T_1	Log W = -5.1913+3.5208 log L	0.9987	0.9974
T_2	Log W = -5.2877+3.5708 log L	0.9978	0.9956
T_3	Log W = -5.3104+3.5609 log L	0.9979	0.9958
T_4	Log W = -4.8660+3.3730 log L	0.9938	0.9876

Table 6 Condition factor 'K' of common carp in experimental tanks.

Tank No.	Value of 'K'
T_1	1.99
T_2	2.00
T_3	1.95
T_4	1.94

Table 7 Carcass composition of common carp fed with control and poultry dropping incorporated test diets.

Content	Pond/Diet			
	T_1/D_1	T_2/D_2	T_3/D_3	T_4/D_4
Protein (%)	45.00	46.25	47.50	46.86
Lipid (%)	11.50	11.68	12.75	12.13

from 1.94 to 2.0 which shows the well being of fishes raised on poultry dropping incorporated fish diets.

Carcass Composition

The analysis of body muscles of the experimental fishes has been presented in Table 7. Incorporation of poultry dropping in test diets increased protein as well as lipid content in the body muscles. No clear effect of poultry manure meal in fish diet on body composition of blue tilapia (Abdalghany *et al*., 1997) and poultry layer waste in fish diet on body composition of hybrid catfish (Jantrarotai and Boonman, 1996) have been reported. The results of the present study are in conformity with Saha and Ray (1998) who found the protein and lipid in the muscle of *Labeo rohita* to be increasing in the dietary treatments pertaining to incorporation of poultry litter in fish diets.

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