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EFFECT OF FORMULATED DIET ON WEIGHT GAIN AND DIFFRENCE WEIGHT OF JUVENILES OF *OREOCHROMIS MOSSAMBICUS*

M. Shoaib[1] and F. Ameer[2]

[1]*Department of Zoology, University of Karachi,Karachi-75270,*
[2]*Pakistan Council of Scientific and Industrial Research(PCSIR), Laboratories Complex Karachi, Karachi-75270*

ABSTRACT

A seventy five days feeding experiment was conducted on juveniles of *Oreochromis mossambicus* having the initial weight of 0.9267±0.1464 g. The ingredients were fish meal @200g/kg, rice protein @530g/kg, boiled rice @100 g/kg, squid @ 20g/kg, shrimp @ 100g/kg, fish oil @ 4 ml/kg, salt @ 025g/kg, minerals @ 0.05g/kg and vitamins @ 10g/kg mixed and fed to juveniles twice a day at 5% of average body weight. The weight gain % and differences between initial and final weights were increased with respect to 0.2833±0.1080 and 21.90 ±11.68 ($P > 0.05$). Food conversion ratio (FCR), protein efficiency ratio (PER) and specific growth rate (SGR) were significantly different from the specimens reared in extensive cultural system.

Key-Word: Formulated diet,nutrition,*Oreochromis mossambicus*.

INTRODUCTION

The science of fish nutrition has advanced rapidly over the twenty five years largely as a result of the development of commercial fish farming. Early researchers in the biology and fish culture relied on natural foods such as fresh animal meat and fishery byproducts for feeding fish. Later, nutritionists attempted to substitute on a nutrient basis other materials in feed formulations. The main objective of feed formulation is to utilize knowledge of nutrient requirements, locally available ingredients and digestive capacity of fish in the development of nutritional balanced mixtute of feed stuffs which will be eaten in sufficient amounts to provide optimum production at an acceptable cost. In recent years, research on the nutrition of Tilapia, carp, cat fish and many other fresh water fishes has been undertaken by several researchers (Anonymous, 1981; 1983, Cowey *et al*., 1985). It is eveident from the earlier studies that the combination of ingredients alter weight gain %, difference weight gain, feed conservation ratio, protein retention energy. The present study was, therefore, carried out to investigate the effects of diet on production rate of experimental fish.

MATERIAL AND METHODS

1. Experimental Design

Three glass aquaria (1.5 x 2.5 x 1.5 feet) located indoor in the laboratory were used for the study. Each aquarium was filled with tap water and was well aerated for a period of 24 h prior to stocking. Forty days old juveniles of *O. mossambicus* reared in these aquria containing 35 frys with the mean initial weight of (0.9267±0.1464). They were fed with experimental diet (Table 1) consisting of mixture of fish meal, rice protein, boiled rice, squid, shrimp, fish oil, salt, minerals, vitamins procured from local market. All ingredients were well mixed by electrically operated homogenizer and extruded through the dry ingredients except oil was measured separately. Mineral premix and vitamin powder were mixed and blended using an electric grinder,the required quantity of fish oil was added and hand mixed until it formed a stiff dough.This was extruded without added heat through a 2 mm die in a hand mincer.The feed was stored in high guage plastic bags under room temperature.

2. Rearing, Feeding and Collection of Faecal matter

Glass aquaria were stocked at the stocking density of 35 frys per aquarium and fed at 5% of average body weight as it is close to maintainence ratio (Cho *et al*., 1982). Daily feed allowance (DFA) was calculated before the start of experiment by using following formula (Oserii, 2000).

DFA = ABW x Stocking density x % Survival x FR.

Where,

ABW = Average body weight, FR = Feeeding rate.

Feecal matter from all aquaria was siphoned out by using 3 mm delivery tube filtered, followed by oven drying for proximate analysis.

3. Analytical Procedures

Proximate Analysis

Moisture and crude protein were determined as described in AOAC (1992). Crude fat was estimated by soxhlet extraction with petroleum ether (BP 60 – 80 ^{0}C) and ash content was determined by the residue remaining after incineration of sample at 550^{0}C in a muffle furnace. Charbohydrates were computed by difference (Crompton and Herris, 1969).The physiological energy was calculated on the basis of 9 Kcal/g of fat,4 Kcal/g for protein and 4 Kcal/g for carbohydrate.

Water Analysis

Physical parameter of water including water temperature and pH were recorded by glass thermometer.Chemical parameters including dissolved oxygen(DO),salinity and choloride were estimated titrametrically. The free ammonia,nitrite nitrogen and nitrate nitrogen were estimated by using chemical test kits.Total dissolved solid (TDS) was recorded by TDS tester.

Analysis of formulated diet efficacy

Specific growth rate (SGR), protein efficiency ratio (PER), average daily weight gain (ADG), condition factor (K) and food conversion ratio (FCR) were calculated by using following formulae:

(i) $$SGR = \frac{\text{Final weight} - \text{Initial weight}}{\text{Time}} \times 100$$

(ii) $$PER = \frac{\text{Weight gained}}{\text{Protein consumed}}$$

(iii) $$ADG = \frac{\text{Final weight-Initial weight}}{\text{Time}}$$

(iv) $$\text{Condition factor (K)} = \frac{W \times 100}{L^3}$$

Where,

W = Weight; L = Length

(vi) $$FCR = \frac{\text{Wt. of food presented}}{\text{Wt. of animal gained}}$$

Statistical analysis of experimental data

Comparison of these findings was statistically carried out by using software t- test (MinitabV.II).

RESULTS

Water quality

The physico-chemical parameters (Table 6) including temperature, pH, dissolved oxygen , free ammonia, nitrate nitrogen, nitrite nitrogen, chloride , salinity and total dissolved solids (TDS) were 27.0±0.80, 6.50±0.50, 4.55±0.23, 0.49±0.25, 16.67±12.83, 2.21±1.21, 13.13±8.12, 2.05±0.45, 470±107.6 respectively. All these parameters differ greatly to the water of extensive culture system.

Formulated diet efficacy

The composition of diet is presented in Table1 containing 47% protein,28.34% carbohydrate,2065% fats,11.34% moisture,10.67% ash and 325k.cal/g. energy.The difference between initial and final weights are 0.926±0.1464 to 2.620±1.01.3 (Table 3) and the value of weight gain (%) was maximunm after the fifteen days of experimental period.It was noticed that these values fluctuated significantly at the end of feeding trial.(Table2). The least value of food conversion ratio (FCR) also clearly indicated that after the fifteen days of experimental period,nutrients in the diet were utilized efficiently when compared with other fifteen days intervals. The specific growth rate (SGR) was also high at this stage.Other factors like average daily weight gain (ADG), protein energy

ratio (PER) and condition factor (K) were approximately similer with trhe exception after fifteen to thirteen days interval (Table 4).

Table 1. Formulation and proximate composition of the experimental diet.

S. No.	Ingredients	Amount per kg.
1.	Fish meal	200 g.
2.	Rice protein	530 g.
3.	Boiled rice	100 g.
4.	Squid	20 g.
5.	Shrimp	100 g.
6.	Salts	0.25 g.
7.	Minerals	0.05 g.
8.	Vitamins	10 g.
9.	Fish oil	40 ml.
S.No.	Proximate composition	Amount in %
1.	Moisture	11.34%
2.	Fats	2.65%
3.	Ash	10.67%
4.	Protein	47.0%
5.	Carbohydrate	28.34%
6.	Energy	325 K.cal/100 g.

Table 2. Mean body weight, difference and weight gain (%) at different times of experiments under experimental and control treatments.

Days	Experimental diet				Control			
	Initial Weight (g.)	Final Weight (g.)	Difference (g.)	Weight Gain (%)	Initial Weight (g.)	Final Weight (g.)	Difference (g.)	Weight Gain (%)
0	0.92	1.19	0.27	29.34	0.89	0.91	0.02	2.24
15	1.19	1.66	0.47	39.49	0.91	0.93	0.02	2.19
30	1.66	1.97	0.31	18.67	0.93	0.97	0.04	4.30
45	1.97	2.11	0.14	7.10	0.97	1.03	0.06	6.18
60	2.11	2.38	0.27	12.79	1.03	1.08	0.05	4.85
75	2.38	2.62	0.24	24.0	1.08	1.13	0.05	4.62

Table 3. Mean ±SD of weight under experimental treatment control at 95% confidence interval (CI).

Day	Experimental treatment		Control	
	Weight(mean±SD)		Weight(mean±SD)	
	Initial	Final	Initial	Final
0	0.9267±0.1464	1.193±0.202	0.89±0.605	0.91±0.657
15	1.193±0.202	1.667±0.467	0.91±0.657	0.93±0.763
30	1.667±0.467	1.9670±0.719	0.93±0.763	0.97±0.765
45	1.970±0.719	2.110±0.762	0.97±0.765	1.03±0.800
60	2.110±0.762	2.383±0.921	1.03±0.800	1.08±0.799
75	2.383±0.921	2.620±1.013	1.08±0.799	1.13±0.775

Table 4. Average DFA, ADG, PER, FCR, SGR and K-Factor at different times of experiment fed the experimental diet and control.

Days	Experimental treatment						Control					
	DFA	ADG	PER	FCR	SGR	K-Factor	DFA	ADG	PER	FCR	SGR	K-Factor
0	1.61	0.018	0.006	4.66	1.80	1.54	1.55	0.0013	0.0008	77.5	0.133	1.58
15	2.08	0.031	0.011	3.19	3.13	1.52	1.59	0.0013	0.0008	79.5	0.133	1.46
30	2.90	0.20	0.007	6.29	2.06	1.57	1.62	0.0026	0.0017	40.5	0.266	1.37
45	3.44	0.009	0.003	15.6	0.93	1.55	1.69	0.004	0.0026	28.16	0.400	1.44
60	3.69	0.018	0.006	8.51	1.80	1.49	1.80	0.003	0.0021	36.0	0.333	1.46
75	4.16	0.016	0.006	10.70	1.60	1.51	1.89	0.003	0.0021	37.8	0.333	1.47

DFA,Daily feed allowance;ADG,Average daily weight gain;PER,Protein energy ratio; FCR,Food conversion ratio;SGR,Specific growth rate;K,Condition factor.

Table 5. Correlation coefficients ® of weight gain% to ADG, PER, FCR, and K of the juveniles of *O. mossambicus*.

	Experiment					Control				
Weight gain	ADG	PER	FCR	SGR	K	ADG	PER	FCR	SGR	K
(%)	0.624	0.854	-0.682	0.717	-0.191	-0.166	0.992	0.796	-0.526	-0.357

Table 6. Physico-chemical parameters of water treated with experimental diet.

Parameters	Days						
	0	15	30	45	60	75	Mean±SD
pH	7	6	6	6.33	7	7	6.55±0.502
Temperature(°C)	28.1	27.7	27.3	27.0	26.3	26.0	27.067±0.807
DO(mg/l)	4.5	4.2	4.4	4.6	4.8	4.8	4.55±0.2345
Ammonia(mg/l)	0.0	0.7	0.53	0.53	0.6	0.6	0.493±0.250
Nitrite(mg/l)	0.0	3.3	3.0	2.0	2.0	3.0	2.217±1.217
Nitrate(mg/l)	0.0	20	10	10	23.33	36.7	16.67±12.83
Chloride(mg/l)	5.49	10.32	28.97	10.04	11.57	12.40	13.13±8.12
Salinity(‰)	1.2	2.1	2.0	2.1	2.4	2.5	2.050±0.459
TDS(mg/l)	260	480	490	496.66	536.55	560	470.5±107.6

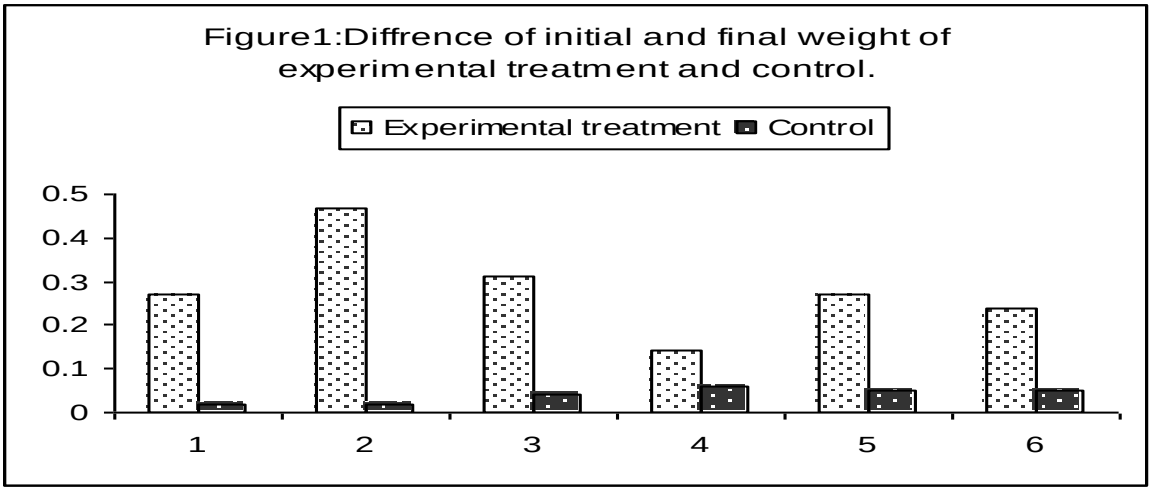

Fig. 1. Difference of initial and final weight of experimental treatment and control.

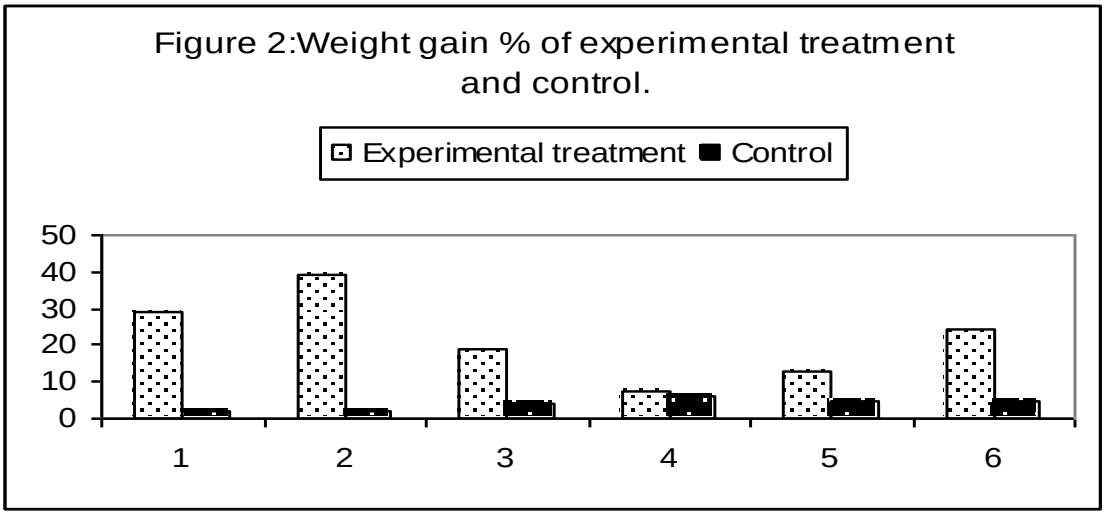

Fig. 2. Weight gain % of experimental treatment and control.

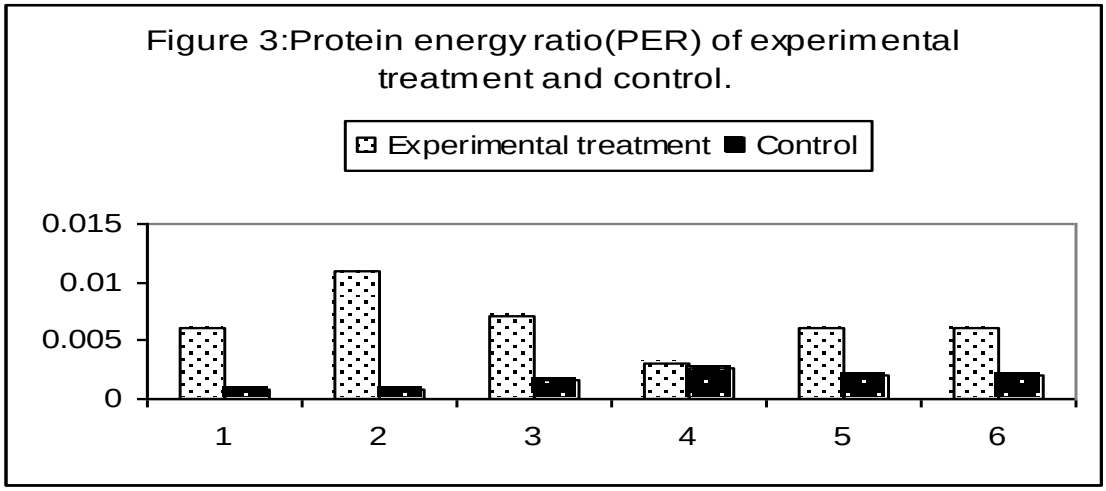

Fig.3. Protein energy ratio (PER) of experimental and control treatments.

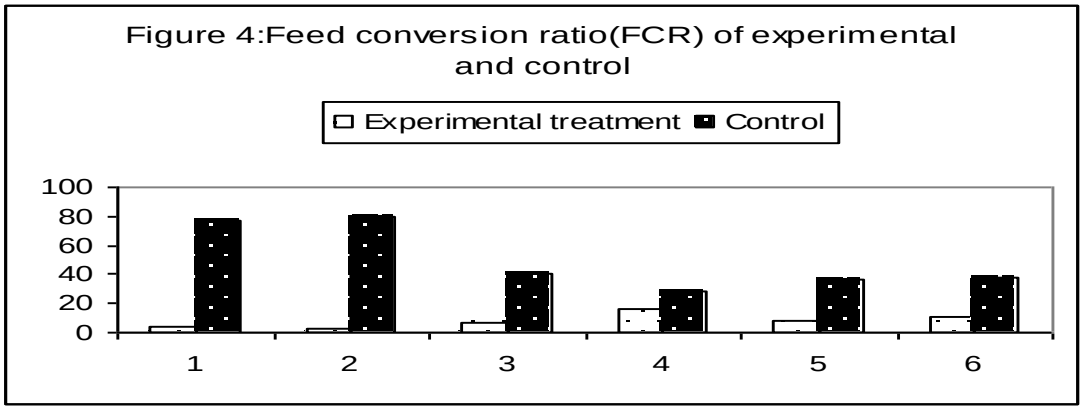

Fig.4. Feed conversion ratio (FCR) of experimental and control.

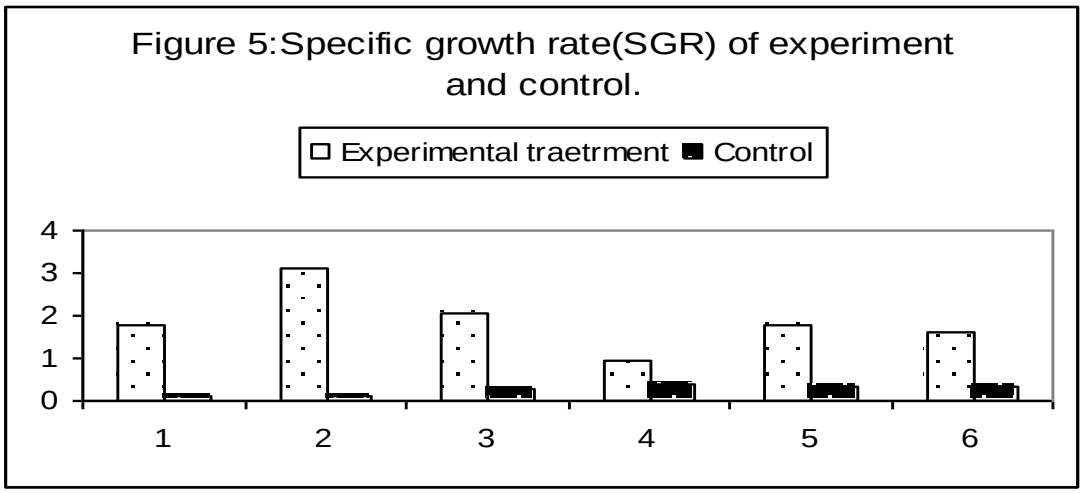

Fig. 5. Specific growth rate (SGR) of experimental and contol.

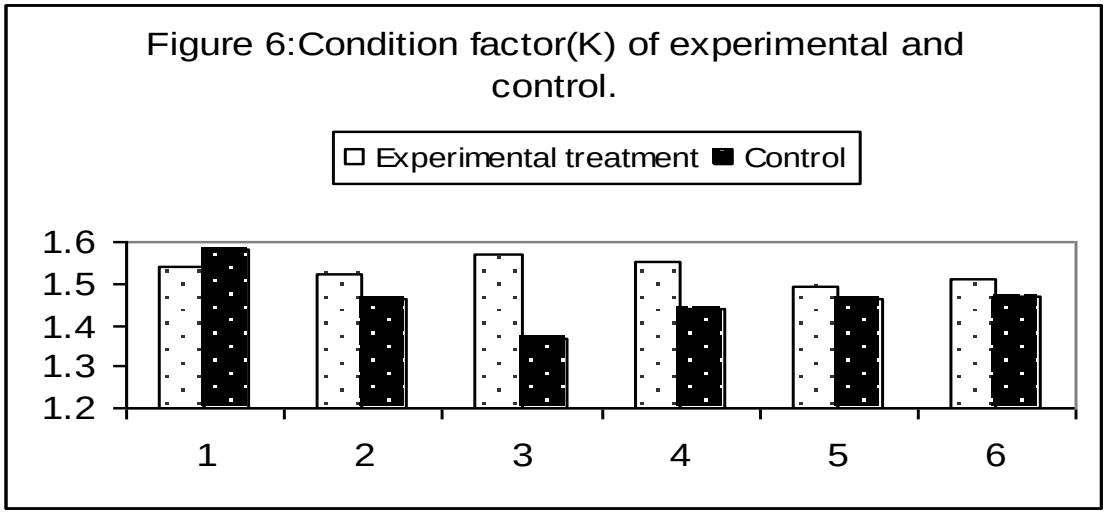

Fig.6. Condition factor (K) of experimental and control.

DISCUSSION

The experimental diet mainly comprises of animal and plant protein with other nutrients (Table 1). The juveniles utilized this nutritive feed and have significant effects on water quality. The excretion of indigestible matter result in an increase of free ammonia, nitrite nitrogen, nitrate nitrogen and dissolved solids, (Table 6). (Alabaster and Lloyd 1980).

The juveniles of *O. mossambicus* grew well on experimental diet indicating that the ingredients composition based on both sources of protein i.e. animal source (fish meal, 200g/kg; squid, 20g/kg and shrimp, 100g/kg) and plant source (rice protein, 530 g/kg). Santiago and Laron (1991) found that the tilapia fry grew best on a 40% protein diet with P/E ratio of 111K.cal/mg. Jauncey (1982) investigated that at 48% of dietary protein level, *O.mossambicus* produced high growth response as investigated in this study.

The differences and weight gain (%) between initial and final weights were found to be non linear (Table 2; Fig 1 & 2) as they fed same feeding rate i.e. 5% of average body weight which is close to the maintenance ration of the specimens.These results were consistent with the findings of De Silva *et al.* (1989) on tilapia. They pointed out that beyond a particular dietary level, the increase rate is lesser relative to a unit increase in dietary protein level until the per unit of maximum growth is achieved.

The efficiency of feed means the amount of food necessary to produce a unit weight of fish and is represented as food conversion ratio (FCR) in Table 4 & Fig 4. As suggested by New (1987) that less value of FCR reflects the more efficient feed and Fig IV indicating the same interpretations. Table 4 & Fig.3 & 5 reflect the use of nutrients and energy concentration by the specimen. Small amount of these nutrients have been used during the physical activities like respiration, locomotion, digestion and ionic balance of the body throughout the study period. Coefficient of correlation (r) of weight was not significantly correlated (Table 5) with the extensively cultural system because of the presence of nutrients in experimental diet which have greatly enhance the growth response of juveniles. The correlations of effectiveness of diet (Table 5) to weight gain % significantly correlate in terms of ADG, PER and SGR while negative correlation have been observed in case of FCR and K- factor.

In view of cost effective feed formulation, a balance of protein, carbohydrate, fats, ash and energy in the diet is of vital importance. High level of protein in diet can alter water quality by the increase of free ammonia, nitrite nitrogen and nitrate nitrogen ultimately cause eutrophication.

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