

Effect of antibiotics on the growth and maturation in goldfish (*Carassius auratus*)

B. AHILAN AND M.J. PRINCE JEYASEELAN

Department of Aquaculture, Fisheries College & Research Institute,
Thoothukkudi-628 008, India

ABSTRACT

The investigation was aimed at determining the effect of antibiotics on the growth and maturation of goldfish. The fishes were stocked in rectangular cement tanks and fed with artificial feed incorporated with antibiotics (virginiamycin and oxytetracycline) at three different concentrations. Among the doses tested for virginiamycin 50 ppm treatment showed highest response for both maturation and growth. The mean weight increment for individual fish was observed to be 4.409 g. In oxytetracycline treatment 150 ppm gave positive result for total weight gain of the fishes.

Introduction

The keeping of ornamental fishes is a hobby with world wide interest. The growing popularity of ornamental fishes is reflected in ubiquitous aquaria that feature as an integral part of modern interior decoration. The world trade in ornamental fish is rapidly expanding day by day. The annual export value of world trade for ornamental fish has been estimated at US \$ 45 billion and the demand is growing up steadily. Goldfish has very good potential in the international market and if production is sufficiently increased besides satisfying local needs export could also be enhanced. The improvement in growth and survival of fish by using antibiotics incorporated feeds have been reported by many researchers (Mitra and Ghosh, 1967; Gornoverkhov, 1967; Rijkers *et al.*, 1980; Viola and Arieli, 1987). The growth promoting action of antibiotics has been reported by Sen and Chatterjee

(1972), Ahmed and Matty (1989) and Sundararaj (1993). The present investigation was carried out to determine the effect of antibiotics on the growth and maturation of goldfish.

Materials and methods

Young *C. auratus* weighing 3.30-3.80 g (4.2-5.6 cm) were stocked in 26 rectangular cement tanks of size 75 x 50 x 40 cm, at 10 individuals per tank. Two different medical grade non-hormonal growth promoting substances such as virginiamycin and oxytetracycline, were incorporated in the control feed at three different concentrations.

The feed for the experiment was prepared with the ingredients of fish meal (16%) groundnut oil cake (16%), sesame cake (16%), soya flour (16%), rice bran (18%) and tapioca flour (18%). The protein level of the feed was 30%. The test diets were prepared by incorporating virginimycin (50, 75 and 100 ppm)

and oxytetracycline (100, 150 and 200 ppm) with the control feed. One set of the fish was fed exclusively with the control feed. The antibiotics were incorporated in the feed after cooking and before extrusion. The fishes were fed at the rate of 10% of the body weight per day and the daily ration was presented as three split feeds. The experiment was carried out for a period of 60 days and the physico-chemical parameters such as temperature, oxygen and pH were monitored periodically.

In this experiment, sample fish were sacrificed to observe gonadosomatic index prior to the commencement of the experiment. Any further changes in the gonad weight as well as growth were also measured on the 30th day and at the end of the experiment (60th day).

Results

Virginiamycin

The data regarding growth, gonad weight and gonadosomatic index (GSI)

of male *C. auratus* experimented with virginiamycin incorporated diets are given in Table 1. In virginiamycin 50 ppm treatment the initial mean body weight (of individual fish) and the corresponding mean gonad weight of fish were 3.644 g and 0.042 g respectively and the GSI value was 1.15. The initial mean body weight and mean gonad weight of the male goldfish in 75 ppm treatment were 3.398 and 0.036 g respectively.

The effect of virginiamycin incorporated feeds on the body weight, gonad weight and GSI of female goldfish are given in Table 2. The initial mean body weight, mean gonad weight and GSI of female goldfish treated with 50 ppm virginiamycin were 3.409, 0.076 and 2.23 g respectively. The GSI increased to 13.42 on 30th day and to 17.62 on 60th day. In 75 ppm virginiamycin treatment, the initial GSI of fish was 2.35, on 30th day it was found to be 10.17 and on 60th day it was observed to be 16.91. The initial mean body weight and mean

TABLE 1. Effect of antibiotics incorporated feeds on the body weight, gonad weight and GSI of male *C. auratus*

Concentrations (ppm)	First day			Thirtieth day			Sixtieth day		
	B.W. (g)	G.W. (g)	G.S.I.	B.W. (g)	G.W. (g)	G.S.I.	B.W. (g)	G.W. (g)	G.S.I.
Virginiamycin (GSI - P = 0.075)									
50	3.644	0.042	1.15	4.989	0.362	7.26	8.053	0.936	11.62
75	3.398	0.036	1.06	4.519	0.319	7.86	7.087	0.812	11.46
100	3.596	0.037	1.02	4.999	0.313	6.26	6.995	0.737	10.54
Oxytetracycline (GSI - P = 0.309)									
100	3.396	0.031	0.91	4.540	0.234	5.15	6.089	0.385	6.32
150	3.354	0.029	0.86	4.705	0.270	5.74	6.639	0.417	6.28
200	3.378	0.023	0.68	4.745	0.184	3.88	5.977	0.371	6.20
Control									
-	3.228	0.025	0.77	4.765	0.098	2.06	6.000	0.310	5.17

TABLE 2. Effect of antibiotics incorporated feeds on the body weight, gonad weight and GSI of female *C. auratus*

Concentrations (ppm)	First day			Thirtieth day			Sixtieth day		
	B.W. (g)	G.W. (g)	G.S.I.	B.W. (g)	G.W. (g)	G.S.I.	B.W. (g)	G.W. (g)	G.S.I.
Virginiamycin (GSI - P = 0.287)									
50	3.409	0.076	2.23	5.028	0.675	13.42	8.985	1.583	17.62
75	3.360	0.079	2.35	4.620	0.470	10.17	8.789	1.486	16.91
100	3.789	0.095	2.51	4.764	0.489	10.26	7.934	1.295	16.32
Oxytetracycline (GSI - P = 0.360)									
100	3.535	0.082	2.32	4.723	0.428	9.06	6.329	1.074	16.97
150	3.245	0.078	2.40	4.692	0.476	10.14	6.792	1.125	16.56
200	3.500	0.084	2.40	4.608	0.416	9.03	6.078	0.954	15.70
Control									
-	3.450	0.080	2.32	4.641	0.228	4.91	6.080	0.569	9.36

gonad weight of individual fish in the 100 ppm treatment were 3.789 g and 0.095 g respectively. The GSI of the fish was 2.51. The GSI increased to 10.26 on 30th day and 16.32 on 60th day. The total weight increment (mean values among the two replicates) in the goldfish treated with different doses of virginiamycin are given in Table 3.

In 50 ppm virginiamycin treatment the total mean weight increment in goldfish on 30th day was 9.115 g (mean value of replicates, each with 10 fishes). On 60th day the total mean weight was 11.420 g (mean value of replicates, each with 8 fishes only). The total weight

gain in this treatment was 20.535 g. The total gain in body weight of fish in the 75 ppm treatment was 13.630 g. The total mean weight increment in fish on 30th and 60th days was 7.125 and 6.505 g respectively for 75 ppm virginiamycin treatment. In 100 ppm virginiamycin treatment the total weight gain was 11.619 g. The total mean weight increment in fish were 7.424 and 4.195 g respectively for 30th and 60th day. The effect of virginiamycin incorporated feeds on the total bodyweight gain of *C. auratus* are shown in Fig. 1.

Oxytetracycline

The effect of oxytetracycline incorporated feeds on the body weight, gonad weight and GSI of male *C. auratus* are given in Table 1. The individual mean body weight and mean gonad weight of the male goldfish treated with 100 ppm oxytetracycline in the initial stage of the experiment were 3.396 and 0.031 g. In 150 ppm oxytetracycline treated male goldfish the GSI in the initial

TABLE 3. Total weight increment of *C. auratus* treated with different doses of virginiamycin incorporated feeds

Concentration (ppm)	Weight increment (g)		
	30th day	60th day	Total
50	9.115	11.420	20.535
75	7.125	6.505	13.630
100	7.424	4.195	11.619

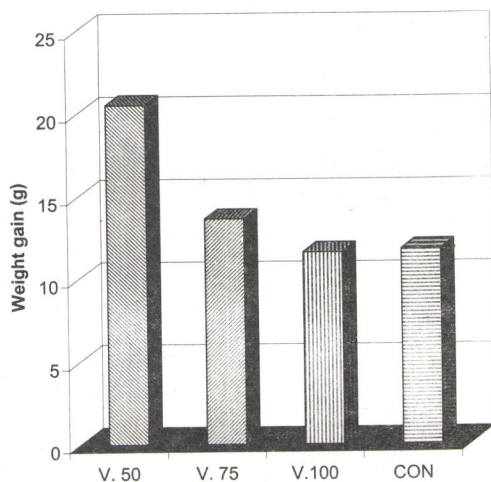


Fig. 1. Effect of virginiamycin incorporated feeds on the total body weight gain of gold fish.

stage was 0.86 and in the final stage it was 6.28.

The effect of oxytetracycline on the body weight, gonad weight and GSI of female *C. auratus* are given in Table 2. The individual mean body weight, mean gonad weight and GSI of the female goldfish in 100 ppm oxytetracycline in the initial stage were 3.535, 0.082 and 2.32 g respectively. In 150 ppm oxytetracycline treatment the individual mean body weight and mean gonad weight on the 1st day of the experiment were 3.245 and 0.078 g. The GSI of the fish was observed to be 2.40 on the first day. The GSI of female fish in the initial stage at 200 ppm oxytetracycline was 2.40 and it increased to 9.03 on 30th day and 15.70 on 60th day.

The total weight increment of goldfish treated with different doses of oxytetracycline incorporated feeds are given in Table 4. The total weight gain in the 100 ppm treatment was 9.540 g. The total mean weight increment in

TABLE 4. Total weight increment of *C. auratus* treated with different doses of oxytetracycline incorporated feeds

Concentration (ppm)	Weight increment (g)		
	30th day	60th day	Total
100	3.715	6.825	9.540
150	5.615	7.360	13.245
200	6.081	3.265	9.346

goldfish on 30th day was 3.715 g (mean value of replicates, each with 10 fishes). On 60th day the total mean weight increment was 6.825 g (mean value of replicates, each with 8 fishes only). In 150 ppm oxytetracycline treatment the weight gain on 30th and 60th days was 5.615 and 7.360 g respectively. The total weight gain was 13.245 g. The total mean weight increment in 200 ppm treatment was 6.081 g on 30th day and 3.265 g on 60th day. The total weight gain in this treatment was 9.346 g. The effect of oxytetracycline incorporated feeds on the body weight gain of *C. auratus* is shown in Fig. 2.

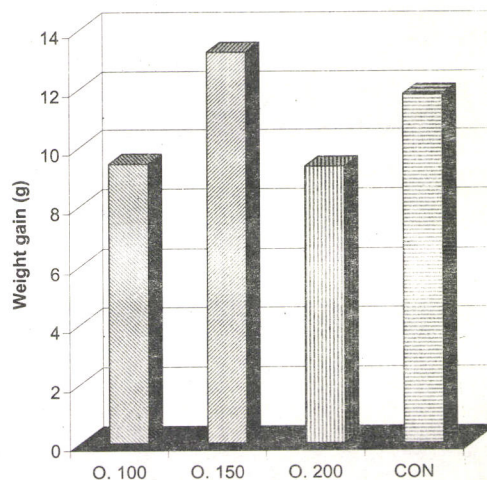


Fig. 2. Effect of oxytetracycline incorporated feeds on the total body weight gain of gold fish.

Disussion

Three different doses were tried for virginiamycin viz, 50, 75 and 100 ppm to enhance the growth and maturation of *C. auratus*. Among the three doses tried the 50 ppm treated fishes have shown highest response to both maturation and growth followed by 75 and 100 ppm. The GSI of the male *C. auratus* treated with 50 ppm was found to be better than 100 ppm. With regard to the GSI of female *C. auratus* the similar trend was observed as that of males.

The growth of the fishes was also found to be high in 50 ppm treatment for both male and female. The mean weight increment for individual fish in 50 ppm treatment was 4.409 g for male and 5.576 g for female. In control the mean weight increment for individual fish was 2.772 g for male and 2.630 g for female. The virginiamycin treated male fish recorded 59% better growth than control. In the case of female treated with virginiamycin, the growth performance was 112% more over control. In virginiamycin treated goldfish better and pronounced growth was observed in the case of females than in the males.

Ahamed and Matty (1989) reported that when antibiotics were incorporated in the protein rich feed, the fish apportioned some portion of protein for its growth. In the present study also, an elevated degree of growth was clearly evident in *C. auratus* fed with the virginiamycin incorporated feed at a protein level of 30%. Sukhoverkhov (1967), Mitra and Ghosh (1967), Sen and Chatterjee (1972) and Ahamed and Matty (1989) also confirmed the positive role of antibiotics as growth promoters

in several fish species. In the present investigation the addition of 50 ppm of virginiamycin in the feed of *C. auratus* positively influenced the growth and maturity than the other concentrations. Ahmad and Matty (1989) also recorded significant effect of virginiamycin at 40 ppm concentration in *Cyprinus carpio*. Administration of virginiamycin in the feed could facilitate an easy and effective digestion of the feed in *C. auratus* as was reflected by the better performance of the fishes as observed by Ahmad and Matty (1989). In the present study, the lowest concentration tried was 50 ppm and it recorded best performance among the doses tested. Further studies are needed to find out the efficacy of virginiamycin incorporated feeds at lower doses (below 50 ppm).

The *C. auratus* was fed with three doses of oxytetracycline incorporated feed viz., 100, 150 and 200 ppm in order to find out whether there was any improvement in gonadial maturity and growth of fish. The increased growth rate was obtained in the Indian major carps treated with oxytetracycline (Mitra and Ghosh, 1967). The mean GSI of the male treated with 100 ppm was 6.32, closely followed by 150 ppm (6.28) and 200 ppm (6.20).

In the case of females also, the mean GSI values were recorded as 16.97 for 100 ppm, 16.56 for 150 ppm and 15.70 for 200 ppm treatment. Though the 100 ppm treatment showed the maximum GSI the difference within the treatments was found to be negligible. The GSI of the control male was 5.17. Hence there was no significant difference in the GSI values observed between the males of control and oxytetracycline. The effect of oxytetra-

cycline in the gonadal development of males was found to be minimal. But in the case of female *C. auratus*, though the difference between the different doses was meager, a good difference was observed between the control and treated fishes. Hence in female *C. auratus* the oxytetracycline had some effect on the gonadal development. Further research is needed to establish the facts.

The oxytetracycline treatment of 150 ppm gave positive results for the total weight gain of the fishes. The total mean weight gain of fish fed with 150 ppm oxytetracycline incorporated feed was 13.245 g. In the other two treatments such as 100 and 200 ppm, the total mean weight gain was lesser than that of 150 ppm treatment as well as the control. The growth promoting action of oxytetracycline at 150 ppm concentration was conforming the reports of many researchers (Sukhoverkhov, 1967; Sen and Chatterjee, 1972; Ahmad and Matty, 1989). Vijayan *et al.* (1990) observed that tetracycline incorporated at 100 ppm level significantly increased the growth and survival of common carp fry.

It was quite interesting to note that at 100 ppm oxytetracycline level, the GSI values showed promising performance while at 150 ppm concentration somatic growth of fish was prominent. The antibiotics incorporated at higher concentration in the feed (200 ppm) exhibited poorer growth than control which could be attributed to the physiological stress of the fish and subsequent effect on its metabolism. The GSI values of the goldfish treated with 100 ppm oxytetracycline were 6.32 for males and 16.97 for females. As far as

the virginiamycin was concerned, among the three doses tried, the 50 ppm treated fishes showed highest response to both maturation and growth. The GSI values of the fishes were found to be high in 50 ppm treatment (11.62 for males and 17.62 for females).

The effect of oxytetracycline in the gonadal development of males was found to be minimal, but in females significant effect was noticed. In both the antibiotics testes, incorporation level at higher doses (100 ppm in the case of virginiamycin and 200 ppm in the case of oxytetracycline) exhibited poor growth.

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