Global Veterinaria 8 (5): 445-448, 2012
ISSN 1992-6197

Effect of 17ß-Estradiol on Growth and Survival of Green Tiger Barb (*Puntius tetrazona*)

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Abstract: The effect of nutritional 17β-estradiol was explored on growth and survival of green tiger barb (*Puntius tetrazona*). Initial fish weight was 0.38±0.01 g. They were proposed to control diet (without17β-estradiol) and control diet supplemented with 50, 25 and 10 mg/kg 17β-estradiol. Rearing period was 60 days. Fish were fed based on 5% of total biomass at the early and 3% at the late rearing period. Results illustrated that there was no significant difference in growth performance and survival rate between different treatments (P>0.05). Growth performance and survival% were lower and FCR is higher in treatment that received 50 mg/kg 17β-estradiol than other treatments but these differences were not significant.

Key words: 17β-Estradiol · Growth · Survival · Green Tiger Barb Fish

INTRODUCTION

The function of sex steroids as inducers of sexual development in fish was first suggested by Yamamoto [1]. His important research led to many trials to improve understanding the role of steroids on fish sexual differentiation, much of these studies have been economic and aquaculture-based, as attributes such as growth, appearance and timing of maturity are often more pleasing in one sex than the other [2]. 17β-estradiol (E2) plays a principle role in female fish, promoting gonadal growth and development [3].

17β-estradiol (E2) is a natural estrogen has been shown to be an useful feminization hormone in some fish [4], E2 produced by the follicle cells in the ovary, persuade VTG gene copy and translation by liver cells [5] in fact, it is synthesized by the follicular layer of the oocyte, with both thecal and granulosa cells being concerned in steroidogenesis [6-8].

Interactions of E2 among the mechanisms regulating growth and reproduction in mammals are well studied but they are fewer well characterized in fish [9]. However, the presence of GH/IGF-I axis components in both testis and ovary of some fish species, as well as receptors for gonadal steroids in somatic tissues indicate interaction between the regulatory mechanisms that govern reproduction and somatic growth in fishes [10-12].

In recent years a lot of the research centers studied the effects of estrogen compounds on animal development and reproduction. By contrast, few studies have been undertaken to explain how endocrine disruptors influence on growth or its regulation [13].

Some studies illustrated that the direct feminization via estrogens caused some raise in fish size [14, 15] but some other researchers showed inconsistent results [16, 17].

Degani [15] reported that direct feminization by estrogens caused some increase in fish size and 17β-estradiol enhanced the growth in ells (*Anguilla anguilla*). Güzel *et al.* [18] showed that estradiol valerate raised the condition factor, had no effects on the growth and FCR, but reduced the survival rate. Johnstone *et al.* [19] found that 17 β-estradiol had no significant effect on rainbow trout and atlantic salmon (*Salmo salar*) growth. Goryczko *et al.* [16] reported that the use of 17β-estradiol delayed rainbow trout growth. Arsenault *et al.* [20], Johnstone *et al.* [21] and Komen *et al.* [22] disclosed that 17β-estradiol had negative effects on parr-smolt Atlantic salmon (*Salmo salar* L.), brook trout (*Salvelinus fontinalis*) and carps (*Cyprinus carpio*) growth performance.

This research was done to explore the effect of dietary 17β-estradiol supplementation on growth and survival in green tiger barb (*Puntius tetrazona*).

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MATERIALS AND METHODS

This study was done in year 2011. The research was conducted using 12 glass aquaria (60×40×30 cm) prepared with single central air pump. A total of 96 fry green tiger barb fish (0.38±0.01 g) were randomly distributed into the aquaria. Water temperature was kept at 27-29°C using under water heaters. Dissolved oxygen, total hardness and pH were 7-8, 270±0.2 mg/l and 8±0.5. Fish were fed on commercial trout pellet (Biomare, France; 0.5 mm in diameter) over a 14-day period for adaptation. Then, the aquaria assigned as 4 triplicate treatments. One of the treatments received the Biomare diet (control group), whereas the remaining were received Biomare supplemented with 50, 25 and 10 mg/kg 17β-estradiol. To reach the 17β-estradiol-supplemented diets, E2 was dissolved in absolute ethanol and sprayed on top of Biomare and then pellets were dried over night. Fish were fed based on 5% of body weight at the early and 3% at the late stages. The fish were fed 3 times daily. Fish were biometry at the experiment commencement as well as fortnightly thereafter and the food quantity was corrected accordingly.

At the end of the experiment, growth performance was evaluated by calculating weight gain (WG), weight gain percentage (WG%), food conversation ratio (FCR) and specific growth rate (SGR) as follow:

$$WG = W_t - W_i$$

$$WG(\%) = 100 * \frac{W_{(t)} - W_{(i)}}{Wi}$$

$$FCR = \frac{CF}{WG}$$

$$SGR = 100 * \frac{\ln W_{(t)} - \ln W_{(i)}}{T}$$

Where W_t was the final weight, W_i was initial weight, CF was total consumed food and T was the experiment duration.

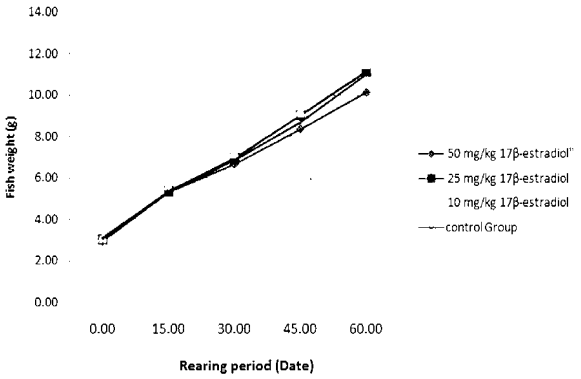

Fig. 1: Growth pattern of different experimental groups

Survival percentage was also calculated by counting the number of remaining fish divided to the primary fish number multiplied to 100.

Data were analyzed using statistical software SPSS v. 18. Data were subjected to one way ANOVA and Duncan's test to find significant effect of diets on growth and survival. $P < 0.05$ considered to be significantly different. Data are presented as treatments mean±SD.

RESULTS

Table 1 shows the growth performance and survival of different treatments after 60 day. There were no significant differences in growth performance and survival rate between the treatments ($P>0.05$). WG, WG%, SGR and Survival% were lower and FCR is higher in treatment that receives 50 mg/kg 17β-estradiol than other treatments but these differences were not significant. Growth pattern of different groups is presented in Figure 1.

DISCUSSION

In this study the obtained results showed no significant differences in growth performance and survival rate between the treatments ($P>0.05$) but WG, WG%, SGR and survival% were lower and FCR is higher in treatment that received 50 mg/kg 17β-estradiol than other treatments.

Table 1: Effect of dietary17β-estradiol supplementation on growth performance and survival in green tiger barb (mean±SD)

17β-estradiol content (mg/kg)	WG	WG%	SGR	FCR	Survival%
50	0.89±0.27[a]	240.29±74.42[a]	2.02±0.37[a]	1.53±0.30[a]	100±0.00[a]
25	1.01±0.08[a]	265.74±11.82[a]	2.16±0.05[a]	1.37±0.06[a]	100±0.00[a]
10	1.05±0.10[a]	267.06±30.94[a]	2.16±0.14[a]	1.37±0.06[a]	100±0.00[a]
Control	0.99±0.15[a]	255.23±31.98[a]	2.11±0.15[a]	1.39±0.09[a]	100±0.00[a]

The result of this study was consist with several other researchers such as Güzel *et al.* [18], Johnstone *et al.* [19] and Parks and Parks [23] in Rainbow Trout (*Oncorhynchus mykiss*), Rainbow trout and Atlantic salmon (*Salmo salar*) and Brook Trout (*Salvelinus fontinalis*) that reported the estradiol uses had no effects on growth.

Johnstone *et al.* [19, 21] illustrated that the growth reduced during the application, but there was no growth variation after the use in time; therefore, the use had no effect on growth.

Some others study, reported that estradiol had significant effect on fish growth [15, 14]. Güzel *et al.* [18] concluded that the condition factor of E2 applied group was significantly ($P<0.05$) higher than that of the control group. Degani [15] used 17 β-estradiol (50 mg kg^{-1}) for 75 days to ells (*Anguilla anguilla*) and reported that its enhanced the fish growth. Hiroaki *et al.* [24] showed 17β- estradiol significantly increased the growth rate of Japanese eel (*Anguilla japonica*) treated with 25 and 50 mg/kg E_2 diet at the early juvenile phase.

Some researchers showed that estradiol postponed the fish growth. Goryczko *et al.* [16] reported that the use of 17 β-estradiol (5 and 20 mg kg^{-1}) for 120 days hold back the rainbow trout growth. Komen *et al.* [22] applied 25, 75 and 125 ppm doses of 17β-estradiol to carps (*Cyprinus carpio*) and reported negative effects of the applications on carp's growth. Hendry *et al.* [25] showed physical deformity and decreased growth in Atlantic halibut (*Hippoglossus hippoglossus*), fed E2 at 10 mg/kg for 45 days all through the range of doses administered, it became obvious that the negative effects of E2 on feeding behavior and following growth increased with dose.

Davis *et al.* [26] clearly indicate that, simultaneous with Vtg induction, E2 suppresses the Gh/Igf1 axis. These results supported this hypothesis that E2 represses somatic growth while encouraging vitellogenesis during gonadal recrudescence in females.

Some researchers illustrated that estradiol had not influence on survival rate [14, 27] but in several other studies reported that E2 application had negative effect on fish survival rate [16, 18, 21, 23, 28].

The difference between the growth, FCR and survival rate findings of the present study and the other studies could be explained by the differences in application time, dose and rate, as well as fish species of the mentioned studies [15, 18, 29, 30].

As a result, we found that the use of 17β-estradiol, by the rate of 10, 25, 50 mg. kg^{-1} for 60 days had no significant effects on growth and survival rate. Therefore, it is not essential to suggest this kind of estradiol application for green tiger barb (*Puntius tetrazona*).

ACKNOWLEDGEMENTS

The authors are thankful to the Department of Fisheries, Faculty of Fisheries and Environment, Gorgan University of Agricultural Sciences and Natural Resources.

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