THE EFFECT OF HORMONE (17α-METHYLTESTOSTERONE, 17β-ESTRADIOL) USAGE ON DEVELOPMENT, SEX INVERSION AND PIGMENTATION OF ELECTRIC YELLOW CICHLID (*Labidochromis caeruleus* FRYER, 1956)

KARSLI, Z.[1*] – ŞAHIN, D.[1] – ÖZ, M.[2] – ARAL, O.[2]

[1]*Vocational School, Sinop University, 57000 Sinop, Turkey*
(phone: +90-368-271-57-38; fax: +90-368-271-57-40)

[2]*Fisheries Faculty, Sinop University, 57000 Sinop, Turkey*

[*]*Corresponding author*
e-mail: zaferkarsli@hotmail.com

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Abstract. This research was designed in order to examine the effects of 17α-methyltestosterone and 17β-estradiol hormone use on the development, growth performance, survival, sex ratio and coloration of the *electric yellow cichlid* (*Labidochromis caeruleus* Fryer, 1956). Seven different groups were designed in the study. While no hormones were added to the control diet, 6 different rates of hormones were added to the other groups. Cichlid mean weight was determined as 0.64±0.01 g, were stored such that three replications for each group. The fish were fed with the feeds for a period of 2 months. At the end of this research, the highest weight gain was determined in the 20 mg kg^{-1} 17α-MT group (0.39±0.17 g). When the sex change rates were evaluated, it was determined that the feminization rates in the 17β-ES hormone group were 80.00%, 82.22% and 86.67%, respectively, and all fishes in the 17α-MT hormone group were 100% male. When the results of the physical color analysis were evaluated, it was determined that the best coloration was obtained in the 17α-MT groups. At the end of the study, the 17α-MT hormone was determined to have a better effect than 17β-ES hormone on the growth, feed conversation rate, sex change and pigmentation of electric yellow cichlid (*Labidochromis caeruleus* Fryer, 1956).
Keywords: *Cichlid spp., sex hormones, growth, sex change, coloration*

Introduction

The aquarium sector is an important trading area in pet hobbies that continues to grow around the world. It is estimated that the global trade value of the sector, which includes about 5300 freshwater fish and 1802 marine fish, is around $ 15-30 billion. The major markets for trade in the aquarium sector are the US, European countries and Japan (Penning et al., 2009; Saxby et al., 2010; Rhyne et al., 2012; Raghavan et al., 2013).

In fish species, hormone applications in feed and water have different effects (growth, sex change, coloration, survival rate etc.). These differences, especially in the fish species, have been found to be due to the type of hormone used and the amounts added. The use of hormones seems to have an important place in the breeding of aquarium fish due to the fact that the fish species to be cultivated are brought to the market in a shorter period of time, the fish are consumed less by consuming less, the fish are produced in the desired sex and the positive effect on the coloring of the aquarium fish is observed (Brzuska, 1999; Pandian and Kirankumar, 2003).

One of the most important features of aquatic organisms is that they have a bright color. The reason of having a bright color, are related with feeding in their natural environment. One of the biggest problems is color loss in aquaculture. In case of this

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problem consumer demand is decrease. The feed given to these species must provide the necessary ingredients for the species to acquire the desired colours (Kop and Durmaz, 2008).

Sex steroids are important for aquarium fish production and coloration of fish. Desired sex can be supplied with these steroids by producers (Turan et al., 2003). Effects of steroid hormones on aquarium fish like as cichlid, beta, guppy, black molly, swordtail and on edible fish like as rainbow trout, salmon, sea bass, eel, carp, tilapia have been already examinated in world (Pandian and Sheela, 1995).

Labidochromis caeruleus is a species of cichlid endemic to the central western coastal region of Lake Malawi in East Africa. They prefer to live in the rocky and rocky regions of Malawi. This species can reach to a length of 15 cm (5.9 inch). In the fins of male fish, the black colors are more dense and wider, while the female have weaker and thinner black lines (Lewis, 1982; Şahin, 1999).

The use of hormones to stimulate sex change in fish, especially in the aquarium industry, has led many aquarium fish producers to pay attention to hormone use in producing expensive varieties that vary in price by sex. Especially in this species (*Labidochromis caeruleus* Fryer, 1956), prices are often higher because male have huge and more attractivecolors. Therefore, the aim of the this research was planned to confirm the effects of hormones on skin colouration, sex inversion and development of *Labidochromis caeruleus* fry.

Materials and Methods

In this study, effects of 17α-Metiltestosteron and 17β-Estradiol hormones on growth, development, survival rate, sex reversal and color parameters of cichlid fish (*Labidochromis caeruleus* Fryer, 1956) were investigated (*Figure 1*).

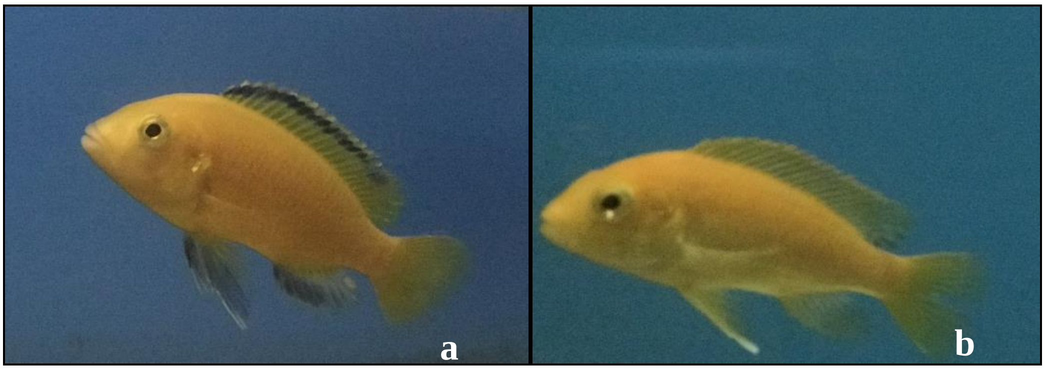

Figure 1. *Male (a) and female (b) electric yellow cichlid (Labidochromis caeruleus) (Original)*

17α -MT and 17β-ES hormones were used in this study because of they are the most effective anabolic steroids for fish (Turan et al., 2003). For this purpose, 500 fry were supplied from a commercial breeder and 315 of them were randomly selected for the experiments. The fish were individually weighed and placed into 30 L aquariums in groups of 15 fish in 3 replications. Throughout the experiments, water temperature was fixed at 26±1°C. Aquarium water characteristics were as follows: Dissolved oxygen >5 mg/l, pH of between 6.0-8.5 ammonia (NH_4^+) content <1 mg/l, photoperiod was natural day light.

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The research was conducted at the Ornamental Fish Farming Unit of the Fisheries Faculty in Sinop University (Sinop, Turkey). Experiments were conducted in 7 groups. The first group was control group (C), the second group was 20 mg kg^{-1} 17α-MT hormone treatment, the third group was 40 mg kg^{-1} 17α-MT hormone treatment, the forth group was 60 mg kg^{-1} 17α-MT hormone treatment, the fifth group was 20 mg kg^{-1} 17β-ES hormone treatment, the sixth group was 40 mg kg^{-1} 17β-ES hormone treatment and the seventh group was 60 mg kg^{-1} 17β-ES hormone treatment (*Table 1*).

Table 1. *Diet groups in trial*

Trial groups	Hormone application	Dosage (mg kg^{-1})
1	Control diet	No hormone
2	17α-MT	20
3	17α-MT	40
4	17α-MT	60
5	17β-ES	20
6	17β-ES	40
7	17β-ES	60

Growth Parameters

Fish growth performance were calculated according to the following formulas:

$$\text{Weight gain (\%)} = 100 * (Wt - W_0)/W_0 \qquad \text{(Eq.1)}$$

$$\text{Specific Growth Rate (SGR, \% day}^{-1}) = 100 \times (\ln Wt - \ln W_0 / t) \qquad \text{(Eq.2)}$$

where; ln = Natural logarithm, W_0 = initial weight (g), Wt = final weight (g) and t = time in days from stocking to harvesting.

$$\text{Survival Rate (\%)} = (\text{number of fish harvested/number of fish stocked}) \times 100 \qquad \text{(Eq.3)}$$

$$\text{Feed Conversion Ratio (FCR)} = \text{feed given (g)/body weight gain (g)} \qquad \text{(Eq.4)}$$

The condition factor (k) of the experimental fish was estimated from the relationship:

$$K = 100 \times (w/L_b) \qquad \text{(Eq.5)}$$

where; W = Weight of the fish in grams, L = The total length of the fish in centimeters, b = The value obtained from the length-eight equation formula.

Colouration Measurements

Instrumental color measurement method was used to determine the fish color. For this purpose, a colorimeter (Konica Minolta CR 400) was used to measure skin color parameters (L*, a*, b* values) of the fish samples from the dorsal sections of the fish (CIE, 1986). C* and H_{ab}^{o} values were calculated by using a* and b* values. The following parameters were determined: **L*:** (+) brightness, (-) darkness, **a*:** (+) redness, (-) greenness, **b*:** (+) yellowness, (-) blueness (Nickell and Bromage, 1998).

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Chroma (Cab*) indicates intensity and purity of the colors and is calculated with the equation:

$$C_{ab}^* = (a^{*2} + b^{*2})^{1/2} \qquad \text{(Eq.6)}$$

Hue angle indicates the relationships among yellowness, greenness and blueness of the color and is calculated with the equations (Hunt, 1977):

$$H_{ab}^{o} = \tan^{-1}(b^*/a^*) \text{ for } a^*>0 \text{ and } H_{ab}^{o} = 180+\tan^{-1}(b^*/a^*) \text{ for } a^*<0 \qquad \text{(Eq.7)}$$

Hue is an angle indicating a red color tone at 0º, yellow color tone at 90º, green color tone at 180º and blue color tone at 270º (Nickell and Bromage, 1998; Yeşilayer et al., 2011).

Statistical Calculations

One-way analysis of variance (ANOVA) was applied to determine the differences in experimental data and the differences in intragroup and intergroup means were calculated with Fisher's test and expressed in mean ± standard error (mean ± SE). Statistical analysis of the study results was performed with "Minitab Release 17 for Windows" software. In terms of water parameters statistical significance among experimental groups were evaluated by one-way analysis of variance (ANOVA) and means were compared using Fisher's range test at 5% level of significant.

Results

Throughout the experiments, temperature, dissolved oxygen, pH and NH_4^+ values of the aquariums were measured at certain intervals and average water temperature was measured as 26.23±0.09 ºC, dissolved oxygen (O_2) content was measured as 6.26±0.07, pH as 8.13±0.03 and NH_4^+ as 2.4±0.08 mg/l.

Growth Parameters and Feed Conversion Ratio

At the end of the experiments, the greatest increase in weight (g), weight gain (%) and specific growth rate were observed in 20 mg kg^{-1} 17α-MT group and live weights increased about 1.5-2 folds at the end of 60-day feeding period. On the other hand, growth and feed conversion were negatively influenced in groups fed with high hormone-containing feeds (*Table 2*). For instance, at the end of the experiments, fish exhibited the least growth in 60 mg kg^{-1} 17β-ES hormone treatments ($P<0.05$). At the end of the this research, feed conversion ratios of the treatments were similar with each other and the best conversion ratio was determined in 60 mg kg^{-1} 17α-MT hormone treatments. Again at the end of the experiments, the best condition factor was determined in 20 mg kg^{-1} 17β-ES hormone treatment group and the differences from the other groups statistically ($P<0.05$).

Survival Rates (%)

With regard to survival rates at the end of the this research, in both 17α-MT and 17β-ES hormone treatments, decreasing survival rates were observed with increasing hormone quantities. The greatest survival rate was determined in 20 mg kg^{-1} 17α-

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MT hormone treatments (86.68±6.67%) and the lowest survival rate was determined in 60 mgkg^{-1} 17β-ES hormone treatments and a statical difference was found between in the 60 mgkg^{-1} 17β-ES hormone group and the other experimental groups (P<0.05) (*Table 2*).

Sex Reversal (%)

With regard to sex ratios of the groups, it was observed that there were 73.33% females and 26.67% males in the control group. In groups treated with testosterone hormone at different ratios (17α-MT 20, 40, 60 mg kg^{-1}), all fish (100%) were composed of male individuals. On the other hand in groups treated with estradiol hormone at different ratios (17β-ES 20, 40, 60 mg kg^{-1}), the greatest ratio was determined in 60 mg kg^{-1} 17β-ES treatment group (86.67% female and 13.33% male) (*Figure 2*).

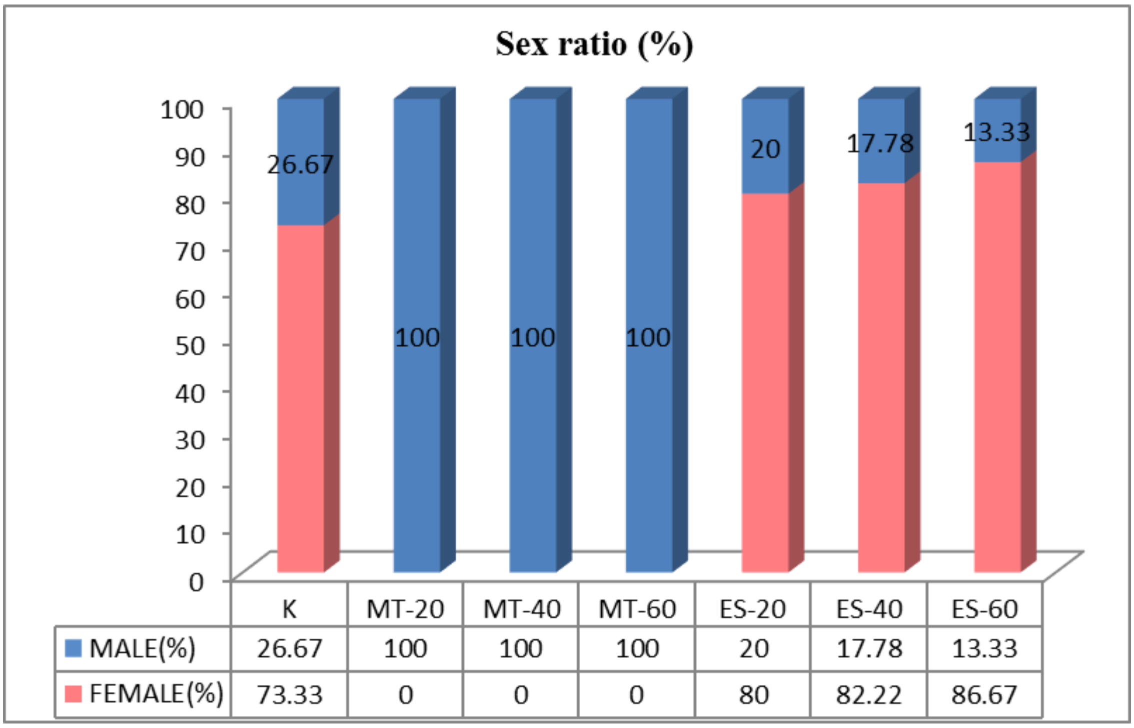

Figure 2. *Sex inversion at the end of study (%)*

Color Parameters

Since the characteristic color of the fish species used in this studs is yellow, b* value was positive in all treatments groups and the greatest b* value was determined in 40 mg kg^{-1} 17β-ES treatments (35.56±5.92). With regard to H_{ab}° angles of the treatment groups at the end of the experiments (from yellow to red), the greatest angle value was observed in 40 mg kg^{-1} 17α-MT treatment group (80.90±1.06) and it was respectively followed by 60 mg kg^{-1} 17α-MT (80.93±0.65) and 20 mg kg^{-1} 17α-MT (81.12±1.52) treatments (*Table 3*).

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Table 2. *Growth performance, feed conversion ratios (FCR), survival and condition factor of electric yellow cichlid at the end of experiment*

Groups	Control	20 mg 17α-MT	40 mg 17α-MT	60 mg 17α-MT	20 mg 17β-ES	40 mg 17β-ES	60 mg 17β-ES
Initial weight (g)	0.64±0.01^{a}	0.64±0.01^{a}	0.64±0.01^{a}	0.64±0.01^{a}	0.64±0.01^{a}	0.64±0.01^{a}	0.64±0.01^{a}
Final weight (g)	0.89±0.18^{cd}	1.03±0.10^{a}	0.97±0.24^{ab}	1.00±0.14^{ab}	0.91±0.15^{cd}	0.94±0.31^{bc}	0.87±0.24^{d}
Weight increase (g)	0.24±0.05^{cd}	0.39±0.17^{a}	0.33±0.11^{ab}	0.35±0.08^{ab}	0.26±0.12^{cd}	0.30±0.06^{bc}	0.23±0.11^{d}
Weight gain (%)	37.40±7.95^{cd}	59.90±27.2^{a}	50.50±17.3^{ab}	54.85±13.12^{ab}	39.70±18.3^{cd}	46.21±8.92^{bc}	34.93±16.81^{d}
SGR*	0.53±0.09^{cd}	0.77±0.29^{a}	0.67±0.19^{ab}	0.73±0.14^{ab}	0.55±0.22^{cd}	0.63±0.09^{bc}	0.49±0.20^{d}
FCR	3.72±0.59^{a}	2.97±1.28^{b}	2.99±1.02^{b}	2.56±0.49^{b}	3.61±0.97^{a}	2.82±0.44^{b}	3.80±1.01^{a}
Survival rate (%)	82.23±3.87^{a}	86.68±6.67^{a}	64.43±7.68^{c}	62.20±10.18^{c}	73.3±23.1^{b}	66.67±6.65^{bc}	53.3±17.7^{d}
Condition factor	1.22±0.03^{c}	1.22±0.04^{c}	1.26±0.09^{bc}	1.26±0.02^{bc}	1.37±0.19^{a}	1.27±0.05^{b}	1.26±0.03^{bc}

Values (mean ± SE) with different superscripts in the same row are significantly different at the 5 % level
*Specific growth rates

Table 3. *Colouration (L, a, b, Cab* and H_{ab}°) measurements of juvenile electric yellow cichlid (Labidochromis caeruleus Fryer, 1956) at the end of the experiment*

Colour parameters	Initial parameters	Groups and end of experiments						
		Control	20 mg 17α-MT	40 mg 17α-MT	60 mg 17α-MT	20 mg 17β-ES	40 mg 17β-ES	60 mg 17β-ES
L*	67.48±0.95^{ab}	69.27±1.29^{a}	68.23±3.20^{ab}	67.51±0.26^{ab}	64.82±4.89^{b}	69.08±2.90^{ab}	71.64±1.06^{a}	71.27±1.56^{a}
a*	-0.51±0.01^{c}	2.36±0.24^{b}	3.81±0.31^{a}	3.76±0.25^{a}	4.23±0.64^{a}	2.72±0.34^{b}	2.71±0.29^{b}	2.91±0.22^{b}
b*	12.98±0.12^{d}	33.43±4.61^{ab}	25.90±1.05^{c}	24.52±1.92^{c}	26.73±2.10^{c}	27.65±1.28^{c}	35.56±5.92^{a}	28.06±3.19^{bc}
Hue (H_{ab}°)	92.44±0.08^{a}	85.70±0.52^{b}	81.12±1.52^{d}	80.90±1.06^{d}	80.93±0.65^{d}	84.26±0.55^{c}	84.05±0.59^{c}	83.86±0.35^{c}
Cab*	13.06±0.07^{d}	31.20±0.65^{a}	26.23±0.97^{bc}	24.89±1.88^{c}	27.09±2.17^{bc}	27.69±1.31^{b}	26.86±2.74^{bc}	27.67±1.19^{b}

Values (mean ± SE) with different superscripts in the same row are significantly different at the 5 % level
Hue (H_{ab}°), chroma (Cab*), lightness (L*), redness (a*), yellowness (b*)

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Discussion

In this study, effects of 17α-Metiltestosteron and 17β-Estradiol hormones on growth, development, survival rate, sex reversal and color parameters of cichlid fish (*Labidochromis caeruleus* Fryer, 1956) were investigated. 17α -MT and 17β-ES hormones were used in this study because of they are the most effective anabolic steroids for fish (Turan et al., 2003).

Physical (instrumental) color analyses were performed on fish before and after the experiments. Physical color analysis is particularly important in determining the color of the ornamental fish skin and is an objective method far from subjectivity. At the beginning of this research, fish skin colors were found in yellow-grey tones according to the initial Hue (H_{ab}^{o}) angles, since the fish were used and the pigmentation did not start at the beginning of the experiments.

According to physical color analysis at the end of the experiments, the best coloration was determined in 17α-MT hormone treatments, coloration increased with increasing hormone doses and the differences from the other groups were found to be significant. Significant differences were also observed between the control and 17β-ES hormone groups. Significant differences were also determined in color changes according to the beginning of experiment of all experiment groups. Larsson et al., (2002) found more reddish tail coloration of guppies from the 8^{th} day of experiments with 17α-MT treatments and determined significant differences from the control group from the 17^{th} day of experiments. In addition, Keskin (2005) reported the initiation of color formation of guppies from the 3^{rd} week of experiments with 17α-MT hormone. Jessy and Varghese (1987) also reported increasing body coloration of *Beta splendens* and *Xiphophorus helleri* species with 17α-MT hormone treatments. Otherwise, Kayım (1997) and Turan (2001) reported that this hormone increases pigmentation and has a positive effect on skin colouration.

The b* values (+) of the control and 17β-ES hormone treatment groups were greater than the b* values of 17α-MT hormone groups and closer to yellow color. Slightly better coloration of 17α-MT hormone groups was because all fish in these groups became male and males of this species have more brilliant colors as compared to the females. Karsli et al. (2016) investigated the effects of 17β-ES and 17α-MT hormones on coloration of *Sciaenochromis ahli* species and differences were reported in fish coloration based on type and dose of hormones. The b* values were all negative (-) in 17α-MT hormone groups. The lowest b* value was determined in 60 mg kg^{-1} 17α-MT hormone treatment and it was respectively followed by 40 mg kg^{-1} and 20 mg kg^{-1} 17α-MT hormone treatments. The b* values of the control and 17β-ES hormone treatments were all positive (+). Yeşilayer et al. (2011) investigated the effects of various carotenoid sources on skin color of *Carassius auratus* species and reported greater a* values for experimental groups, thus indicated darker red tones with carotenoid sources than the control treatments. Researchers also indicated based on carotenoid sources that b* values were positive (+) and all of experimental groups had low H_{ab}^{o} values. On the other hand, Yanong et al. (2006) fed swordtails fry with 17α-MT hormone diets for 28 days and continued the observations until the 6^{th} month and reported that there were not any significant differences in coloration of the experimental groups.

The differences in growth parameters of the experiments statistically significant ($P<0.05$). George and Pandian (1996) reported that the study on zebra cichlid species

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shows a decrease in the growth of fish at doses higher than 100 mg kg^{-1} of 17 β-ES and 400 mg kg^{-1} of 17α-MT. Karsli et al. (2016) in a study with *Sciaenochromis ahli* species, used different doses of 17β-ES and 17α-MT hormones and indicated that 17α-MT hormone groups exhibited better growth than the 17β-ES hormone groups and the differences in growth performance of treatment groups were significant. Carhalvo et al. (2014) used two different doses of (50, 100 mg kg^{-1}) of 17β-ES hormone on growth of *Centropomus undecimalis* and the differences in growth of control group than experimental groups were significant. Lim et al. (1992) indicated that five different doses of 17α-MT and 17β-ES hormones (50, 100, 200, 500 and 750 mg kg^{-1}) did not have any significant effects on growth parameters of swordtails. Tamaru et al. (2009) carried out a study again with swordtails and the optimum dose for feminization was 400 mg kg-1 and reported that there was no adverse effect on growth. The results obtained in this study different from the above studies. Feed conversion ratio is a significant parameter with direct impacts on operational costs of the growers based on the feed quantities of feed consumed by the fish. Kayım (1997) found that 17α-MT hormone treatment had positive effects on feed conversion rates in sword tail and by Karsli et al. (2016) in *Sciaenochromis ahli* species. Güzel et al. (2006) carried out a study with trout and indicated that 17β-ES hormone had not any significant effects of feed conversion ratio. Accordingly, 17α-MT hormone treatments had more positive effects on feed conversion ratios than the 17β-ES hormone treatments. Contrary to the present study, Smith and Phelps (2001) reported that 17α-MT hormone treatments have non-significant effects on feed conversion ratios of the Nile tilapia.

Considering the survival ratios of the fish, these two hormones had negative effects on survival specially at higher rates. George and Pandian (1996) applied two different hormones on zebra cichlids and indicated decreasing survival rates at higher doses. Tamaru et al. (2009) used five different doses of 17β-ES hormone on swordtails and indicated the optimum dose as 400 mg kg^{-1} and carried out the lowest survival rate in 200 mg kg^{-1} treatment and also indicated that the differences from the other groups were significant. Carhalvo et al. (2014) used two different doses of (50, 100 mg kg^{-1}) of 17β-ES hormone on survival rate of *Centropomus undecimalis* and found that the differences of all experimental groups were nonsignificant.

In a study carried out with *Poecilia sphenops* species known as black molly in ovoviviparous fish, George and Pandian (1998) applied different 17α-MT doses and reported important decreases in survival rates at doses over 200 mg kg^{-1}. Das et al. (2010) applied 17α-MT hormones at different doses (15, 30, 60, 120 mg kg^{-1}) for 3 weeks on Tilapia fry and found the survival rates of experimental groups as 92.45%, 95.41%, 93.75% and 89.00% respectively. Çelik (2002) applied five different doses (20, 30, 40, 50, 60 mg kg^{-1}) of 17α-MT hormone to *Oreochromis niloticus* and reported the greatest survival rate for 40 mg kg^{-1} 17α-MT hormone group and the lowest survival rate for 50 mg kg^{-1} 17α-MT hormone treatment. Kayım (1997) reported the survival rates of 17α-MT hormone-treated swordtails as 100%.

With regard to sex ratios at the end of the experiments, it was determined in control group that 73.33% of the fish were female and 26.67% were male. In treatment groups with estradiol hormone (17β-ES) at different doses, the best sex reversal was determined in 60 mg kg^{-1} 17β-ES hormone treatments (86.67% female, 13.33% male). On the other hand, in treatment groups with testosterone hormone (17α-MT) at different doses, all of the fish (100%) were male. It was observed that 17α-MT hormone was successful in sex reversal at all doses. Besides, it was through that 17β-ES hormone

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could also increase the success ratio in sex reversal at higher doses, but mortality rates could also increase with increasing hormone doses, thus such negative impacts limited the increase in hormone dose. Tamaru et al. (2009) used different doses of 17β-ES hormone to swordtails and reported the optimum dose for feminization as 400 mg kg^{-1} 17β-ES (97%). In the same study, female ratio of the control group was reported as 74.5%.

Jessy and Varghese (1987) applied 17α-MT hormone to *Beta splendens* and *Xiphophorus helleri* species and determined the greatest male ratio (90.9%) in 120 mg kg^{-1} 17α-MT treatment group. James and Sampaty (2006) used different doses of 17α-MT hormone and reported the male ratio as 100% for 20, 40 and 60 mg kg^{-1} 17α-MT treatment groups of *B. splendes* and for 40, 60 mg kg^{-1} 17α-MT treatment groups of *X. helleri*. Kiporus et al. (2011) also reported 100% male ratio for 2, 3 and 4 mg kg^{-1} 17α-MT treatment groups of *B. splendes* species, reported 90% male ratio for 1 mg kg^{-1} hormone treatment group and 60% for the control group. Lim et al. (1992) reported that 500 and 750 mg kg-1 17α-MT hormones were effective in production of males sword tail population, while 500 and 750 mg kg^{-1} 17β-ES hormones were effective in production of females sword tail population. In addition, they indicated that single-sexed populations would occur when high doses of both hormones (750 mg kg^{-1}) were administered for 30 days. Similarly, George and Pandian (1996) applied two different hormones on zebra cichlids and determined the greatest male ratio in 200 mg kg^{-1} 17α-MT treatments (55%) and the greatest female ratio in 200-300 mg kg^{-1} 17β-ES treatments (100%). George and Pandian (1998), reported the best sex reversal for *Poecilia sphenops* species in 50 mg kg^{-1} 17α-MT hormone treatment group. Turan (2001) used 17α-MT hormone to guppies and reported the greatest male ratio (75.7%) for 60 mg kg $^{-1}$ hormone treatment. Sezgi and Berkcan (2008) applied 60 mg kg^{-1} 17α-MT hormone to tilapia for 28 days from the first day of feeding and obtained 100% male population. Similarly in the same fish species, Das et al. (2010) used 17α-MT hormone and reported the greatest male ratio (96%) for 60 $mgkg^{-1}$ hormone treatment. Shen et al. (2015) reported that 20, 50 and 100 mg kg^{-1}17α-MT hormone were not effective in male *Pelteobagrus fulvidraco* ratio.

Conclusion

It was concluded based on present findings on this fish species that 17α-MT hormone could provide advantages for better growth, feed conversion ratio and coloration. In this way, fish may reach to marketable size with fewer feed consumption, thus productions costs could be reduced and alluring fish with desired colors could be obtained.

Two hormones which used in this study have positive and negative effects on electric yellow cichlid (*Labidochromis caeruleus* Fryer, 1956), but considering the effect on growth, development, feed evaluation, coloration, sex and survival rate of 60 mg kg^{-1} 17α-MT hormone and 40 mg kg^{-1}17β-ES hormone groups were determined to be appropriate dose amounts for this species. In addition, it is thought that the use of different doses of 17α-MT and 17β-ES hormones for cichlid species will be useful in subsequent studies.

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