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EFFECT OF TESTOSTERONEUNDECONOATE ON GROWTH OF GOLDEN GREY MULLET (*Mugil aurata* RISSO, 1810) IN FRESH WATER

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Abstract
Fish, catched from Yumurtalık-Yelkoma Lagoon, Adana, Turkey, was acclimated to fresh water in two days. Then fish (initial weight of 7.16±0.40 g and initial length of 9.14±0.19 cm) was stocked into test tanks and fed with diets containing testosteroneundeconoate (TU) in different doses (0 mg/kg feed (control), 10 mg/kg feed, 20 mg/kg feed and 30 mg/kg feed) during sixty days. Fish samples were taken randomly once each twenty days. Fish weight and total length were measured.
Mean body weight (W), total length (L), weight gain (WG), daily growth rate (DGR), specific growth rate (SGR), mortality (M) of the fish in each group was calculated at the end of each sample period of the experiment. At the end of the experiment, the highest weight and length values were obtained from first group (18.62±0.0 g and 12.10± 0.0 cm, respectively) (P<0.05). The values of these parameters in the other groups were lower than that in the first group. Values of DGR and SGR of first group also were different statistically from the values of the other groups (P<0.05). Mortalities observed in all groups were ranged between minimum 42.9±14.3 % and maximum 80.0±10.0 %. Differences of mortalities among the groups were significant statistically (P<0.05).
As a result, dosage of TU administered to 1st group (10 mg/kg feed) can be recommended for the culture of this species in fresh water.

Keywords*: Mugil aurata, Fresh Water, Acclimate, Hormone*

1. INTRODUCTION

Mullets (Mugilidae) are common in almost all the seas of the world. They have economical importance. Global aquaculture production was approximately 121365 tons while capture production was 23927 for grey mullet of the world in the year of 2002 [1].

Members of this family (11 genera and 120 species [2, 3, 4] are found in all tropical and subtropical regions. Because of being euryhaline and eurytherm, mullets can tolerate salinity between 0 $‰_0$ and 60-70 $‰_0$ and live in water temperature between 0 ^{0}C and 38 ^{0}C. Additionally, they can live long time in 0,32 ppm dissolved oxygen level and pollute water with high H_2S [2, 5, 6, 7,8, 9, 10, 11, 12, 13, 14, 15, 16].

Approximately 20 mullet species have been cultured in a lot of regions of the world [17]. Especially extensive culture of the mullets is fairly old and still common [18]. There are 8 mullet species in seas of Turkey [15] but any mullet has not yet been cultured commercially there. Mullets in Turkey generally are obtained from lagoon fisheries [5, 8]. Aegean and Mediterranean Regions of Turkey are subtropical regions and have fresh water, brackish and saline water. It will be useful to take in interest in mullet and its mono and polyculture in fresh water also in Turkey like in other countries having subtropical and tropical climate properties.

As it is known, very different kind of materials can be added to feed in order to stimulate feed intake and the growth of fishes. Anabolic hormones are among these substances [19]. Testosteroneundeconoate (TU) is one of the anabolic hormones. Although it is found a lot of studies about administration of different hormones to fish, there are insufficient studies using it on fish growth.

This study was carried out with the aim of determining the effects of TU on growth of *M. aurata* and contributing to its culture researches in fresh water.

2. MATERIALS and METODS

This study was performed at Fresh Water Fisheries and Culture Research Station of the Fisheries Faculty of Çukurova University (FFCRS), Turkey. Golden grey mullet (7.16±0.40 g, 9.14±0.19 cm) was catched from Yumurtalık-Yelkoma Lagoon in the southern of Turkey, then transferred to FFCRS. Fish was firstly stocked into 3 acclimating concrete tanks having water in 15 ppt salinity**,** then acclimated gradually to fresh water within two days by chancing 50 % (in first day) and 100 % (in second day) of the tank's water with fresh water. Fish was not fed in first day but tried to be fed very less in second day of the acclimation [20]. After fish was maintained there one day more because of providing of the feed intake, 10 fish was randomly transferred and stocked to experimental freshwater test tanks (3.20 x 0.40 x 0.50 m in size, concentrate and divided 4 equal parts with nets).

Fish feeds (commercially granule carp feed, 42 % -at least 28 %- crude protein, Pınar Company, Izmir, Turkey) were prepared by spraying the hormone, TU [4,21] in three doze (10 mg TU / kg feed (1st Group), 20 mg TU / kg feed (2nd Group), 30 mg TU / kg feed (3rd Group)). Control diet was treated in the same way as other treatments except adding hormone. Fish was fed ad libitum and 3 times in a day. All the groups were experienced in repetition.

Total 15 l/min water (from Irrigation Canal of Seyhan Dam Lake and well water) was used to the experimental tanks. During the experiment the rearing water in each tank was oxygenated by supplying air from an air blower.

Temperature and dissolved oxygen were measured once in the middle of each day during experiment (by Mettler Toledo Mark Oxygenmeter). Water temperature and dissolved oxygen values were mean 23.6±0.03 ^{0}C and mean 4.34±0.03 mg/l, respectively in the study.

Once a 20 day, all the fish from each tank was removed and then weighted and measured individually. At the end of the study, growth performance parameters and mortality were calculated by below equations. All statistical analyses of final weight and length values and the values of growth performance parameters of the groups were performed using Duncan Multiple Range Test in "SPSS 10.0" package program [22] and 0,05 significance level.

$$SGR = \frac{\ln Wt - \ln Wo}{t} x100$$

$$WG = Wt - Wo$$

$$C = \frac{W}{(L)^3} x100$$

$$DGR = \frac{Wt - Wo}{t}$$

$$M = \frac{Nd}{Nt} x100$$

where as; W: weight (g), L: length (cm), SGR: specific growth rate (%), Wt: final weight value (g), Wo: initial weight value (g), t: treatment time (day), C: condition factor (%), WG: weight gain, DGR: daily growth rate (g), M: mortality (%), Nd: died fish number, Nt: total fish number.

3. RESULTS

Means of the body weight and total length of the fish in each sampling period were given in Table 3. 1 and 3. 2, Chart 3. 1 and 3. 2. SGR, DGR, C, M, and WG values were shown as in Table 3. 3.

The highest final body weight (18. 62±0.0 g) and total length (12.10±0.0 cm) means were obtained from the 1st group (10 mg TU / kg feed). It showed 2.5 fold higher growth than control group and 1.5-2 fold higher growth than the 2nd group.

		Mean Body Weight (g)		
Groups	Sampling Periods (days)	20	40	60
Control Group		7.985±0.16a	9.630±0.84a	11.610±0.21a
1. Group		11.740±2.39c	15.885±0.00c	18.620±0.00c
2. Group		9.891±0.47b	12.870±0.15b	14.800±0.49b
3. Group		7.580±0.57a	10.025±0.47a	11.565±0.94a

Table 3. 1 Mean Body Weights of the Groups in Each Sampling Period

Groups	Sampling Periods (days)	Mean Body Weight (g)		
		20	40	60
Control Group		9.11±0.29a	9.69±0.25a	10.26±0.00a
1. Group		10.25±0.78c	11.61±0.00c	12.10±0.00c
2. Group		9.86±0.23b	9.86±0.23b	11.18±0.12b
3. Group		8.82±0.47a	10.17±0.00a	10.60±0.20a

Table 3. 2 Mean Total Length of the Groups in Each Sampling Period

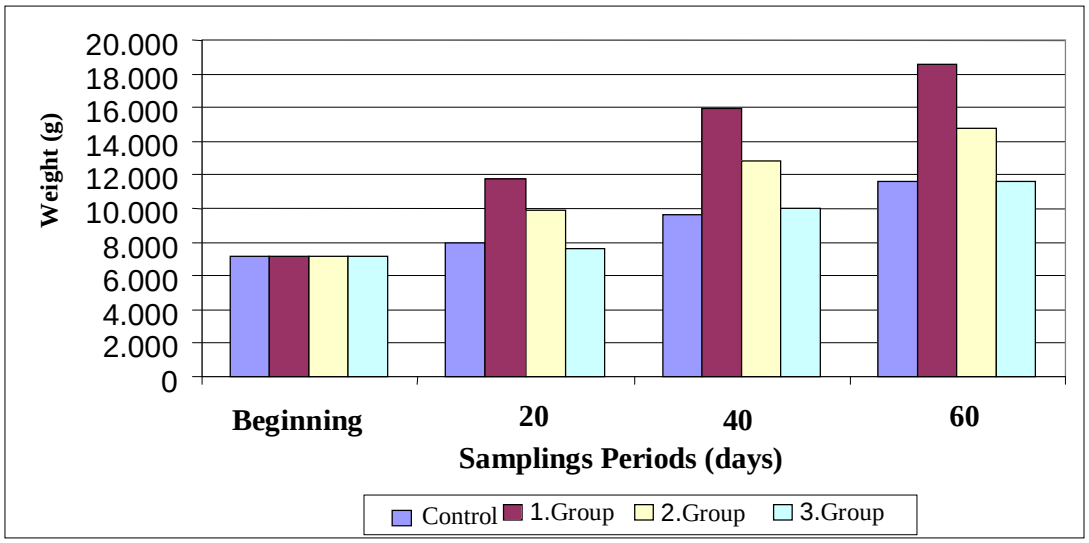

Chart 3. 1 Increasing of mean body weight of fish in each group.

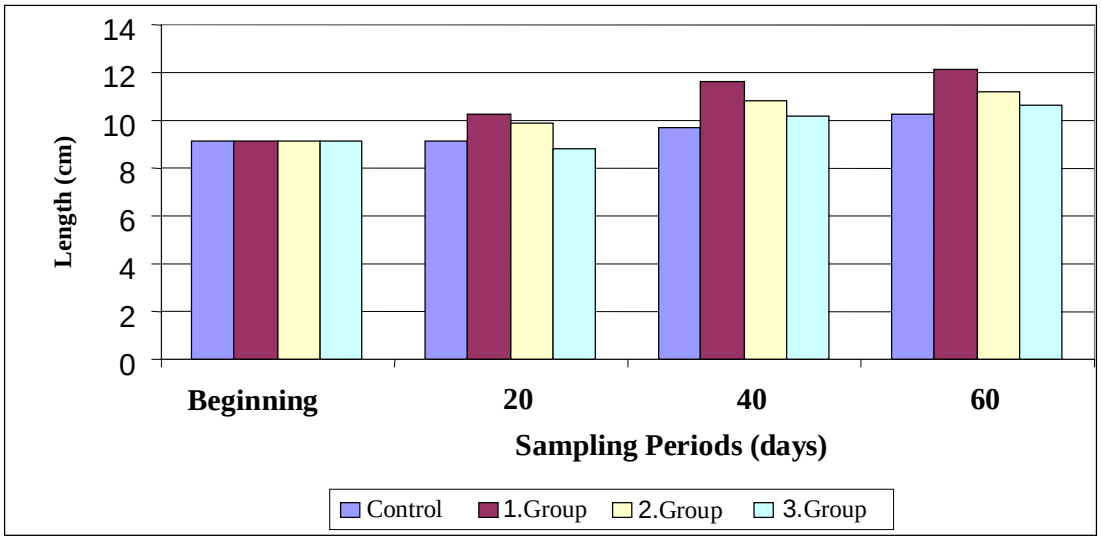

Chart 3. 2. Increasing of mean total length of fish in each group

The lowest final weight was seen in the 3rd group but the lowest total length value was obtained from control group (Table 1 and 2). The 2nd group followed the 1st group for mean body weight. SGR value of 1st group was 1.59± 0.0. Mean WG, DGR, and C values of the fish groups were 11.463±0.001 g, 0.1911±0.00 g, 1.05±0.00, respectively. Mortalities were different in repetitions of groups. Lowest mortality value was seen in control group (42.9±14.3 %) while highest value was obtained from 3rd group (80.0±10.0 %).

Groups	SGR (%)	C	DGR(g)	M (%)	WG (g)
Control Group	0.81±0.03a	1.05±0.04a	0.074±0.004a	42.9±14.3a	4.455±0.21a
1. Group	1.59±0.00c	1.08±0.00a	0.1911±0.00c	55.0±35.0b	11.463±0.001c
2. Group	1.21±0.06b	1.06±0.001a	0.127±0.008b	65.0±15.0c	7.641±0.49b
3. Group	0.79±0.14a	0.97±0.02a	0.074±0.02a	80.0±10.0d	4.406±0.94a

Table 3. 3 Mean SGR, DGR, C, M, and WG values of the fish in each group

4. DISCUSSION

Effect of TU on growth of golden grey mullet (*Mugil aurata* RISSO, 1810) in fresh water was investigated in this study. There is no enough research about hormone administration on this species. Some hormones and their compounds were applied in order to determine their effects on testicular and ovarian maturation, oocyte development, and spawning [23, 24, 25, 26]. There are few researches on mullet culture in Turkey. The present study can be accepted as a first in its field because the previous studies were completed in sea or brackish water.

Tolerance of the mullets to fresh or salt water during acclimating is limited by species [15, 27] fish size [15, 28], water temperature, and water salinity [10]. Fish could acclimate to fresh water with no mortality (0 %) and begin to feed in a short time in this study.

As it is known, the values of the optimum water temperature and dissolved oxygen level for growth of mullets are 20-23 ^{0}C, 5-6 ppm, respectively. These parameters of the water in the study were proper for the fish. Values of temperature and dissolved oxygen in all the pond's water were found insignificant statistically ($P>0.05$).

Differences of mean body weight and length values of the 1st and 2nd groups were found high and significant statistically ($P<0.05$). Differences of SGR and DGR of groups were also significant statistically ($P<0.05$) (Table 3), while C was insignificant ($P>0.05$) (Table 3). As regards all growth parameters, the values of the 1st group were different statistically from those of the other groups ($P<0.05$). According to these results, it can be said that this hormone affects fish growth in these dosages, except that of 3rd group. Because of being different of mortalities in repetitions of the groups it can be implied that mortality was not depend on the hormone dosage but could be sensitivity of the fish to handling.

There are different studies on members of Mugilidae. In one of them, belonging to Cordana [29], it was exposed that growth of mullets affected with seasonal changes was higher in June and August than that in other months. There is high competition between mullets in natural areas [30]. It was informed that *M. aurata* fries reached from 1 g to 120.3 g body weight with 68 % mortality during 3 years [31]. *M. aurata* fries (0.2-

0.5 g body weight) caught from entrance of the river could be reared successfully in culture conditions [Brusle, 1981 from 18]. Ağırağaç and Kalma [18] stated that Undrea (1984) found that *M. aurata* fries reached from 42.32 g to 231.75 g at the end of 180 days. Growth of *M. capito* increases when water temperature increases but salinity decreases [Hoşsucu, 1985 from 16]. Post larvae of *M. capito* was reached from the size of 1.3-2.3 mm to 6.7 mm (4.17 g) between 8-26 ^{0}C water temperature and between 28-38 $\%_0$ salinity during a year [Hoşsucu, 1985 from 16].

Bozkurt and Seçer [16] informed that Alpbaz and Hoşsucu (1979) found that *M. capito* fries grew out from 0.64 g to 12.58 g body weight in 17 ^{0}C water temperature and 15.1 $\%_0$ salinity conditions during 5 months. *M. aurata* fries grew out from 23.9 g to 70.47 g body weight with 95 % survival rate in cages in salt water between June and August [32].

Researches above were carried out in salt water in natural and laboratory conditions. Low salinity increases fish growth, however there is no information about in fresh water (0 $\%_0$ salinity) [Hoşsucu, 1985 from 16]. The present study was completely carried out in fresh water conditions. Fresh water rearing of mullets and its polyculture has been performed in some European and Far East Countries and Israel. In Turkey, mullet culture has been carried out newly and generally in sea or brackish water. Therefore, this study is expected to help for system of mullet rearing, culture project, and researches in future.

5. CONCLUSION

According to these results, this hormone in these dosages affected fish growth. Dose of the first group showed the most important effects from point of view of all growth parameters ($P<0.05$).

In the future, mullet culture has been thought to increase such as cultures of gilthead sea bream, sea bass, trout, salmon, turbot and shrimp because of increasing demand but decreasing of mullet populations in lagoon and sea due to excessive fishing and other factors. TU, at the rate of 10 mg/ kg feed, is found proper to increase the golden grey mullet growth in fresh water. It is believed that this study will contribute to fish culture studies especially in Turkey and the other countries having tropical and subtropical climates and especially having fresh water.

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