

*Short Communication***EFFECT OF HORMONAL TREATMENT ON SEX REVERSAL OF NIL TILAPIA (*OREOCHROMIS NILOTICUS*) FRY**ALI ABUMHARA A.<sup>1</sup>, MAHMOUD YADEM S.<sup>2</sup>, SOVJAK R.<sup>1</sup><sup>1</sup>*Department of Animal Production and Food, Institute Tropics and Subtropics, Czech University of Life Science, Prague, Czech Republic*<sup>2</sup>*Department of Animal Husbandry, Faculty of Veterinary Medicine, Alexandria University, Egypt***Abstract**

*This study was conducted to develop a short-term immersion procedure for masculinisation of Nile Tilapia (*Oreochromis niloticus*) by using 17 $\alpha$ -methyltestosterone at 100, 200 or 400  $\mu$ g/l for 3, 6 or 12 h. Fry were immersed tow successive times with 3 days interval period. The highest percentage of male *Oreochromis niloticus* ( $96 \pm 4\%$ ) and the lowest gonado-somatic index of female *Oreochromis niloticus* ( $1.89 \pm 0.02$ ) were obtained by immersion of Fry in 17 $\alpha$ -methyltestosterone at the level of 400  $\mu$ g/l for 6 h. However, survival rate of *Oreochromis niloticus* Fry during hormone treatment period did not differ significantly from survival rate in the control group.*

**Key words:** tilapia; androgen; methyltestosterone; oreochromis niloticus; sex reversal; males; sex ratio

**INTRODUCTION**

Tilapia culture is widespread around the world, the problem of over population in fish ponds caused by uncontrolled reproduction a major constraint to the further development of the Tilapia culture industry. This problem could be overcome by culturing all-male populations of Tilapia (Gale et al., 1995). One of the most common techniques for producing all-male populations of Tilapia is androgen-induced-sex-reversal by using androgen-treated feed (Veracruz and Mair, 1994). Van Dentturk et al. (1989) who found that GSI of female claries gariepinus decreased when high dose of MT (300  $\mu$ g/l) administered, Chatain et al. (1999) found that MDHT did not significantly affect the gonadal development of *Dicentrarchus labrax*. However, the immersion of Fry is not fully developed for practical usage (Gale et al. 1999). Feeding androgen carries some potential disadvantages as inefficiency in masculinization immersion of Tilapia fry in androgen solutions. One of the alternative methods to oral administration of androgen is well developed in salmonid culture; however, it remains largely experimental in Tilapia culture. The objectives of this research are to develop short-term immersion procedure for the masculinisation of Nile Tilapia by using 17 $\alpha$ -methyltestosterone and evaluating the most proper dose concentration and hormone treatment period.

**MATERIALS AND METHODS**

The experiments were conducted at Shemese Fish Hatchery, Edko, Behera Governorate, Egypt and Laboratories of Faculty of Veterinary Medicine, Alexandria University, Egypt.

Newly hatched *Oreochromis niloticus* fry were obtained by artificial spawning using hapa according to the method described by Bautista et al. (1988) and randomly assigned to 10 groups. Each group was being replicated 3 times. Fry were stocked in 4 liter glass jars with 3 liters of fresh water at stocking density of 33 fry/liter (Gale et al., 1999). The water in the jars was maintained at  $25 \pm 2^\circ\text{C}$  under constant aeration. Fry were immersed in 17 $\alpha$ -methyltestosterone hormone at 100, 200 or 400  $\mu$ g/l for 3, 6 or 12 h immersion period. Control group included the immersion of fry in the water only. After immersion, the fry were collected and stocked in jars that contained fresh water. The immersion was repeated after 3 days for all groups.

During hormone treatment period, fry were fed a powdered feed consisting of 30 % (by weight) fish meal and 70 % rice bran (Veracruz and Mair, 1994). Fry were fed to satiation 4 times daily

After the immersion period, 150 randomly selected fry per group were transferred from the jars to 2 m<sup>2</sup> nursing hapas suspended in their respective 150 m<sup>2</sup> earthen ponds

for 3 weeks prior to their release into the ponds. At the end of grow-out period which lasts for 112 days, 50 fish from each group were individually weighted and the gonads were weighted for calculation of gonado-somatic index (GSI) according to Crivelli (1981). Moreover, the fish were individually sexed by examination of squash preparation of gonads after a ceto-carmin squash method (Guerrero and Shelton, 1974). Sex ratio was expressed as a percentage.

Survival rate was estimated for Tilapia fry during hormone treatment period. Statistical analysis of the obtained data was performed using Statistical Analysis System, SAS (1987).

## RESULTS AND DISCUSSION

It is clear from the obtained data that the immersion of *O. niloticus* fry in 17 $\alpha$ -methyltestosterone (MT) at 400  $\mu$ g/litre for 6 hours resulted in the highest percentage of male populations ( $96 \pm 5\%$ ), followed by  $88 \pm 4\%$  and  $86 \pm 5\%$  males in groups 9 and 7, which immersed in 400  $\mu$ g MT/l for 12 h and 3 h, respectively (Table 1), while using the hormone at the level of 200  $\mu$ g MT/l, produced lower male percentage ( $80 \pm 6$ ,  $78 \pm 4$  and  $82 \pm 4\%$  males in groups 4, 5 and 6, respectively) than the results obtained in fish groups which were treated at 400  $\mu$ g MT/l. The lowest male percentage was obtained in fish groups which were treated at the hormonal level of 100  $\mu$ g MT/l. These results agree with those obtained by Gale et al. (1999).

**Tab. 1:** Percentage of males, females and intersexes *Oreochromis niloticus* in different group

Groups	Males	Females	Intersexes
1. 100 MT** 3 h	$76 \pm 5^d$	$24 \pm 5^b$	—
2. 100 MT 6 h	$80 \pm 6^c$	$18 \pm 5^c$	$2 \pm 4^b$
3. 100 MT 12 h	$78 \pm 7^{cd}$	$22 \pm 5^b$	—
4. 200 MT 3 h	$80 \pm 6^c$	$20 \pm 5^{bc}$	—
5. 200 MT 6 h	$78 \pm 4^{cd}$	$18 \pm 5^c$	$4 \pm 8^a$
6. 200 MT 12 h	$82 \pm 4^{bc}$	$18 \pm 5^c$	—
7. 400 MT 3 h	$86 \pm 5^b$	$14 \pm 5^d$	—
8. 400 MT 6 h	$96 \pm 5^a$	$4 \pm 5^e$	—
9. 400 MT 12 h	$88 \pm 4^b$	$12 \pm 5^d$	—
10. Control	$52 \pm 4^e$	$48 \pm 5^a$	—

\*Means  $\pm$  standard error with different superscripts in each vertical row are significantly different ( $p < 0.05$ )

\*\*MT = 17 $\alpha$ -methyltestosterone; h = Immersion period in hours

Immersion of *O. niloticus* fry for 3 h at the hormonal level of 400  $\mu$ g MT/l produced  $86 \pm 5\%$  males; this result is lower than that obtained by Gale et al. (1995) who have produced 93–100% male *O. niloticus* fry by immersing the fry in 500  $\mu$ g/l of 17 $\alpha$ -methylidihydrotestosterone (MDHT) for 3 h. These results can be explained on the basis that the treatment used in the present research may not represent an optimal dose of steroid or it may be due to conversion of MT to a less active form or simply a faster rate of clearance from the body than MDHT. Another possible explanation for the differing effects of the two steroids is that MDHT is more potent masculinizing agent than MT. The present research may overcome these problems by increasing immersion period of MT from 3 h to 6 h.

Inter-sexes appeared as a low percentage, 2% and 4% in groups 2 and 5 which were treated at 100 and 200  $\mu$ g MT/l for 6 h. However, no inter-sexes individuals were found at the higher (400  $\mu$ g MT/l) hormonal levels. These results agree with those obtained by Berger and Rothbard (1988) who found that the higher percentage of inter-sexes Red Tilapia (received diets containing 17 $\alpha$ -methyltestosterone) appeared at the lower hormonal doses.

It is clear from the obtained data (Table 2) that both male and female hormone-treated *O. niloticus* had significantly lower GSI compared to untreated fish (control groups). These results are confirmed by those of Veracruz and Mair (1994).

**Tab. 2:** Gonado-somatic index (GSI) of males and females *Oreochromis niloticus* in different groups

Groups	GSI		
	males	females	intersexes
1. 100 MT 3 h	$0.82 \pm 0.04^{b*}$	$2.20 \pm 0.18^d$	—
2. 100 MT 6 h	$0.83 \pm 0.03^b$	$1.95 \pm 0.11^e$	$1.24 \pm 0.00^a$
3. 100 MT 12 h	$0.68 \pm 0.03^d$	$2.60 \pm 0.08^b$	—
4. 200 MT 3 h	$0.77 \pm 0.04^{bc}$	$2.37 \pm 0.09^c$	—
5. 200 MT 6 h	$0.76 \pm 0.05^c$	$2.51 \pm 0.08^b$	$1.02 \pm 0.00^b$
6. 200 MT 12 h	$0.82 \pm 0.06^b$	$2.30 \pm 0.09^{cd}$	—
7. 400 MT 3 h	$0.79 \pm 0.03^{bc}$	$2.37 \pm 0.02^c$	—
8. 400 MT 6 h	$0.83 \pm 0.04^b$	$1.89 \pm 0.02^e$	—
9. 400 MT 12 h	$0.71 \pm 0.03^{cd}$	$2.62 \pm 0.09^b$	—
10. Control	$0.93 \pm 0.03^a$	$2.75 \pm 0.09^a$	—

\*Means  $\pm$  standard error with different superscripts in each vertical row are significantly different ( $p < 0.05$ )

\*\*MT = 17 $\alpha$ -methyltestosterone; h = Immersion period in hours

The lowest GSI of female *O. niloticus* was obtained in group 8 ( $1.89 \pm 0.02$ ), which was treated at the highest hormonal level ( $400 \mu\text{g MT/l}$ ) for 6 h. This result is confirmed by the work of Van Dentturk et al. (1989) who found that GSI of female claries gariepinus decreased when high dose of MT ( $300 \mu\text{g MT/l}$ ) was administered. It is known that high doses of androgen may result in a decrease of masculinizing potency and retardation of gonad development.

Gonado-somatic index of male *O. niloticus* which immersed for 3 h at the levels of 100, 200 and  $400 \mu\text{g MT/l}$  ( $0.82 \pm 0.04$ ,  $0.77 \pm 0.04$  and  $0.79 \pm 0.03$ , respectively) was not affected significantly by the level of hormone. These results agree with those obtained by Chatain et al. (1999) who found that MDHT did not significantly affect the gonadal development of *Dicentrarchus labrax*.

Survival rates of *O. niloticus* fry in different groups during hormone treatment period were nearly similar (ranged from  $88.9 \pm 2.18$  to  $93.6 \pm 0.48\%$ ) and did not differ significantly from survival rate in the control group (91.9).

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