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THE GROWTH AND SURVIVAL OF VARIOUS FORMS ANDROGEN SEX – REVERSAL OREOCHROMIS NILOTICUS CULTURED USING HAPAS IN CONCRETE TANK

A. Omoike[3]*, A. E. Falaye[2], F. C. Okoye[1] and S. Abubakar[1]

[1]National Institute for Freshwater Fisheries research, New Bussa, Niger State Nigeria.
[2]Department of Aquaculture and Fisheries management, University of Ibadan, Ibadan.
[3]Department of Biological Sciences, Bells University of Technology, Ota, Nigeria.

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***Corresponding Author**
Dr. A. Omoike
Department of Biological Sciences, Bells University of Technology, Ota, Nigeria.

ABSTRACT

The production of same sex *Oreochromics niloticus* to enhance better and uniform growth for Tilapia culture has called for technological means using sex-reversal hormones Methyl Testosterone (MT), this study will look into the percentage growth and survival of *Oreochromics niloticus* fry. The experimental fish *Oreochromics niloticus* fry of 0.90 cm total length were fed with three artificial feeds treated with three forms and concentrations of Methyl Testosterone (MT): Treatment A has 30mg/kg in tablet form, Treatment B was 30mg/kg in oil form and Treatment C was 50mg/kg in tablet form. A 35 days trial feeds were fed to the fish 5 times each day to obtain all male Tilapia fry population and grown to fingerling stage in outdoor tank for 56 days. The sex – reversal efficiency of the MT was analyzed after feeding the fry/fingerlings in hapas mounted inside outdoor tank. Conversion efficiency, condition factor and survival rate of the fry/fingerlings were also analyzed. The result obtained from the study shows that the sex reversal was effective in that the male: female ratio was significantly different ($p > 0.05$) in favor of the male. The temperature had significant effect on the growth rates of the fingerlings, but showed no effect on their survival ($p > 0.05$). The food conversion ratio and condition factor did not show any significant difference ($p > 0.05$). This study shows higher form of the tablet of MT seems to be more potent than the oily form, The highest average final weight was recorded in treatment B but the FCR shows no significant difference ($p > 0.05$) in the treatments, this study has revealed that the different form and concentration of

Methyl Testosterone (MT), has potency for growth rate, sex reversal with high survival rate of Tilapia fry.

KEYWORDS: Methyl Testosterone, *Oreochromis niloticus*, growth, survival, sex reversal.

INTRODUCTION

Among all the fish families in Nigeria, Tilapia is one of the cheapest sources of animal protein (Ita, 1984). Megbowon and Mojekwu (2014) said that Tilapia has become the second most important finfish in aquaculture after carps and because of their large size, rapid growth and palatability, the focus of most aquaculturist are on number of Tilapiine cichlids. The main species cultured in ponds, cages and pens is the Nile tilapia (*Oreochromis niloticus*). It is low in the food chain but generally has the problem of over-population due to the culture system especially in ponds. Jiménez-Badillo and Arredondo-Figueroa (2000) reported that a major problem in commercial farms of tilapia species is their tendency to overpopulate ponds, for this reason all-male population of tilapia is desirable in grow-out ponds to eliminate or reduce reproduction. Among the methods developed to overcome the problem, hormonal sex reversal had been suggested as a possible solution and research in this area has received increased attention The problem with this fish is their early maturation and ability to breed every month (Megbowon and Mojekwu, 2014). This problem leads to stunted growth, which could be solved through monosex culture system. Monosex culture could be achieved by manual sexing, hybridization and hormonal sex – reversal.

Hormonal sex – reversal is widely recognized as having significant advantage over both manual sexing and hybridization (Guerrero, 1987, Andrew, 1983). This technique involves the use of either androgen or estrogen treatment to over ride the androgenous sex determining mechanism in the developing embryo of fish and channel it to a male or female direction. According to Megbowon *et al.* (2009) sex –reversal in tilapia, involves the treatment administration of male steroid to recently hatched fry so that the undifferentiated gonadal tissue of generic female develops testicular tissue, thus functioning reproductively as males. Hormonal control of reproduction by sex – reversal is gradually gaining ground in aquaculture in Nigeria, the most recent acceptable method in improving the productivity of cultured fish and its application is gaining high popularity in commercial fish farming practice. The objective of this study is therefore:

a. To produce all – male *Orechromis niloticus* fry through the administration of hormone.

b. To compare the potency/efficiency of the two forms of the hormone.
c. To determine the growth and survival of the fingerlings produced through the hormonal sex – reversal.
d. To determine the percentage of the fingerlings that have been sex – reserved at the end of the study.

MATERIALS AND METHODS

Study area: The study was carried out at the NIFFR's hatchery complex, using both the indoor and outdoor facilities.

The indoor system

Six experimental flow-through plastic tanks of the indoor hatchery system were used for the first phase of this study which involves the application of the hormonal system to the *Oreochromis niloticus* fry. The plastic tanks were filled with water to a volume of 30 liters and covered with chicken – wire tray to prevent the treated fish from jumping out. The tanks were fitted with both inlet and outlet devices to maintain a simple flow – through system. The tanks were allocated to three treatments in two replicates under a completely randomized design.

The outdoor system

An outdoor tank measuring 10 X 10 X 1.5 meters was used for the growth of the fry after the sex – inversion. A total of six net hapas of mosquito net mesh size with dimension of 1 X 1 X 1 meter were used and Kuralon rope was used to hold the hapas in a good position, about half – way submerged in water.

Experimental fish

Orechromis niloticus breeders were collected from the Institute's integrated poultry – cum fish culture system and stocked in a prepared nursery tanks measuring 5 X 5 X 1.0 meter. The 12 breeders were stocked in the ratio of one male to three females and fed with pelleted feed of 30% crude protein at 5% body weight, twice daily, morning and evening.

After about three weeks, fry were observed in this nursery tank and were seined out of the tank and conditioned in a breeding through with adequate feeding and aeration for 24 hours. About 240 fry within the range of 9mm to 11mm total length were collected from the thorugh, weighed and stocked in the flow – through tanks at the rate of 40 fry per tank.

Preparation of the experimental diet

The diets for the sex – inversion were prepared by alcohol evaporation method of Shelton *et.al*. (1978). The National Institute for Freshwater Fisheries Research (NIFFR) compounded pelleted feed of 30% crude protein level was used for this study. About one kg of the feed was ground in a mortar. Three forms of the androgen MT (tablet form, 30mg/kg, oil form, 30mg, kg/kg) were dissolved in 10ml of 10% solution of ethyl alcohol and each mixed with one kg of the ground feed. Each feed type was replicated. The thoroughly mixed feeds were oven dried at a temperature of 100^0C for 6 hours. After oven – drying, the feeds were ground again into fine powder and packaged in plastic bags.

The pelleted feed of 30% crude protein level used in feeding the fry in hapas in outdoor system was formulated using two ingredients, mix flour and blood meal under Peterson Square method.

Experimental Design and Procedure

The three treatments used for this study were

MT tablet at 30mg/kg - A

MT oil form at 30mg/kg - B

MT tablet at 50mg/kg - C

These were replicated, using six flow through tanks. About 40 fry were stocked in each tank after taking initial weight and total length. Subsequent measurements of weight and length were weekly.

Feeding Rates and Feeding frequency

The hormone – mixed feeds were fed to the fry at 10% body weight. The fry were fed 6 days in a week and 5 times daily at 7.00am, 10.00 am, 1.00 pm, 4.00 pm and 7.00 pm. The weighed ration for the day was divided into 5 equal parts and each part fed to the fry at each feeding period by sprinkling the feed into a feeding ring at the centre of each tank.

After 35 days the fry was transferred to the 6 net hapas in the outdoor concrete tank and fed with formulated pelleted feed of 30% c. p at 5% body weight, twice daily. These Frys were sampled fortnightly while mean weight, total length and survival rate were determined.

Water quality parameter

Water quality parameters monitored during the experimental period include; temperature, dissolved oxygen and pH. The temperature was measured with a laboratory hand thermometer calibrated from 0^0C to 100^0C. The dissolved oxygen was measured using the Winkler's method while the pH was monitored using the Lovi – Bond comparator with Bomothymol as an indicator.

Determinant of percentage male

The percentages of male in the various treatments was obtained by viewing the genital papilla with the aid of hand lens and ink and by dissecting the fish if there is any doubt.

The result obtained for the various parameters under test were subjected to analysis of variance to determine if either the treatment or their replicates had significant effect on the parameters. The chi-square test (x^2) was used to determine the sex – reversal efficiency.

RESULT AND DISCUSSIONS

Growth rate

The fry in treatment B had the highest growth rate of 3.507mg/day followed by treatment C (3.446mg/day) and lastly by treatment A (3.362mg/day). The average length gained of the experimental fish in treatment B was 4.185cm, followed by treatment C (3.025cm) and lastly by treatment A (2.56cm). The highest average final weight was recorded in treatment B (1.21g), followed by treatment C (0.58g) and the least was treatment A (0.36g).

The analysis of the mean growth rate shows that there are no significant differences between the treatments and that the treatment had significant effect on the growth rate of the fish. This shows that the basal ingredient in the sex – reversal treatment had growth promoting effect on the fish. This was also observed by Lan (1982) that androgen, estrogen and thyroid hormones, (growth hormones) are shown to have growth promoting effect in fish given in appropriate doses. As against the report of Jiménez-Badillo and Arredondo-Figueroa (2000) who reported that the use of Androgen have no significant effect on growth.

The best food conversion ratio of 1.68 was recorded in treatment B and the least (FCR) in treatment A (1.82). Analysis of variance of the FCR showed no significant difference in the treatments ($p < 0.05$).

The highest condition factor was recorded in treatment C (0.965), followed by treatment B (0.905) and the least was treatment A (0.885). Analysis of variance of the condition factor showed no significant difference in the treatments ($p < 0.05$).

Survival and Male reversal ratio

This survival rate observed after the 35days indoor and 56 days outdoor of trial demonstrate good survival ratio which agrees with the report of Jiménez-Badillo and Arredondo-Figueroa (2000) that the hormone has no negative effects on the tilapia fry. The survival rate ranged from 60.0% to 87.5%. The mortality of the fry could be attributed to stress during sampling and cleaning of the experimental tanks. Despite this, the good survival ratio could be attributed to good water quality management and conducive physico – chemical conditions of the culture medium.

The highest percentage of male was obtained in treatment C (98.5%), followed by treatment A (96.5%) and the least was treatment B (83.5%). This shows that the tablet form of MT seems to be more potent than the oil form and the higher the concentration of the tablet form, the more the potency. This agrees with the report of Jiménez-Badillo and Arredondo-Figueroa (2000) who reported the effectiveness of the MT treatment at a dosage of 40 mg/kg of feed supply during 30 days to produce phenotypic males. Which also agrees with those of Kuwaye *et al*. (1993), Ladu and Madara (1994), who demonstrated the effectiveness of MT in other species.

The mean weekly record of some physico – chemical parameters (pH, DO and ^{O}C) shows that they are all within the tolerable range for the culture of Tilapia. The mean temperature ranged from 29^0 to 33^0C. The DO ranged from 5mg/l while pH was observed to be between 7.1 and 7.6.

Table 1: Stocking density, growth and survival % of the fish at the indoor tank.

Treatment	No stocked initial mean weight	Initial mean weight (g)	Final mean weight (g)	No Survived	% Survival
A1	40	0.011	0.148	27	67.5
B1	40	0.011	0.512	33	82.5
C1	40	0.011	0.180	28	70.0
A2	40	0.011	0.144	24	60.0
B2	40	0.011	0.400	35	87.5
C2	40	0.011	0.170	30	75.0
Total	40	0.065	1.554	177	442.5
Mean	40	0.011	0.259	29.5	73.75

Table 2: Stocking density, growth and survival % of the fish at the outdoor tank.

Treatment	No stocked initial mean weight	Initial mean weight (g)	Final mean weight (g)	No Survived	% Survival
A1	27	0.148	0.35	22	55
B1	33	0.512	1.349	32	80
C1	28	0.180	0.631	18	45
A2	24	0.144	0.38	17	42.5
B2	35	0.400	1.089	34	85
C2	30	0.170	0.542	28	70
Total	177	0.554	4.341	151	377.5
Mean	29.5	0.259	0.724	25.2	62.9

SUMMARY AND CONCLUSION

Orechromis niloticus fry were sex – reversed by oral administration of MT at the rates of 30mg/kg and 50mg/kg (tablet form) and 30mg/kg (oil form) for 35 days in NIFFR indoor hatchery complex and allowed to grow to fingerling stage in outdoor tank for 56 days.

Increase in length and weight were measured as well as percentage survival. In the end the percentage male was recorded by observing the genital papillae or dissection.

The mean growth rate of fry treated with oil MT was the highest though it showed no significant difference to the fry treated with MT tablets. It can be said that the tablet MT is more potent than the oil MT.

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