

# Effect of sex reversal hormone (17 $\alpha$ -methyltestosterone) on growth performance and survival rates of *Heterobranchus longifilis* fry

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**ABSTRACT:** The study aimed at determining the effect of sex reversal hormone (17 $\alpha$ -methyltestosterone) on the growth performance and survival rate of *Heterobranchus longifilis*. The experiment consisted of five treatments replicated three times in a completely randomised design. Mature and gravid broodstocks of *H. longifilis* were purchased and bred in the laboratory to obtain fry that were used for the study. One hundred and fifty (150) fry of the same age (three days), 4 mm in size, were used for the study. The fry was stocked in 15 plastic bowls of 4 litres each at 10 fry per bowl, 30 fry per treatment. The experimental feed (75g) was divided into five equal parts of 15g for the experimental treatments, 20mg of the hormone was dissolved in 75ml of ethanol and was mixed thoroughly with spatula for about 5 minutes and was added to 15g feed each at 1.0ml, 2.0ml, 3.0ml, 4.0ml and 0ml respectively and was mixed thoroughly with 0.5ml Cod liver oil purchased from a pharmacy, to avoid clumps, and then was left to dry under room temperature for 24hours. The dried feeds were labelled as MTSR<sub>0</sub>, MTSR<sub>1</sub>, MTSR<sub>2</sub>, MTSR<sub>3</sub>, and MTSR<sub>4</sub>, as control, treatment 2, 3, 4 and 5, respectively. The fry was fed 3% body weight with the treated diet for 28 days, after which feeding was continued with normal, untreated formulated fish feed for another 56 days. The result of the study showed that fish fed 17 $\alpha$ -methyltestosterone showed significantly improved growth performance compared to fish fed a diet without 17 $\alpha$ -methyltestosterone. The highest and best growth was observed in fish fed a diet containing 4.0mls 17 $\alpha$ -methyltestosterone with 246.0g, 591.1%, 1.47, 1.84 and 68.03% in weight gain, percentage weight gain, feed conversion ratio, specific growth rate and feed efficiency, respectively. Survival rate was highest 63.33% in MTSR<sub>3</sub> and MTSR<sub>4</sub> respectively, followed by 60.00% in MTSR<sub>0</sub> and MTSR<sub>2</sub>, respectively. The results of the study further showed that the highest sex occurrence of 89.47% and 78.95% males was recorded in the fish fed experimental diets containing 4.0mls and 3.0mls 17 $\alpha$ -methyltestosterone, respectively, and the lowest 50.00% in the control. The study clearly indicated that the inclusion of 17 $\alpha$ -methyltestosterone in the diets significantly altered the sex ratio towards male and enhanced the growth performance in the sex reversed fish.

**Keywords:** 17 $\alpha$ -methyltestosterone, fry, broodstock, survival rate.

## INTRODUCTION

Fisheries and aquaculture make crucial contributions to the world's food security and prosperity, which play a major role in augmenting the ever-increasing global demand for seafood products (Kari *et al.*, 2020). To ensure the sustainable growth of aquaculture industry, aquaculture industries can explore innovative approaches that will enhance fast growth in fry, and fry survivability, due the

high demand of fish products as a result of the global population expansion, there is a the need to improve on artificial propagation of fish fingerlings to promote the growing aquaculture industry in shorter grow-out cycle which can be of advantage to the commercial fish production. Sex reversal in fish was suggested by Olufeagba and Yisa (2011) as a way of improving the

growth performance, as they avoid poor feed conversion that is associated with sexual maturation.

In aquaculture, Mono sex populations of fish are desirable. The male grows faster in some species, and the female grows faster in other species. In this case, mono sex culture of the faster-growing sex can increase production (Dunham *et al.*, 1990; Lu *et al.*, 2022).

*H. longifilis* is a species that presents a high fecundity (up to 120 ovules per l/kg of body weight) and a very high growth rate (8-12g/day-l for average body weights ranging from 200 to 900g) (Legendre *et al.*, 1992).

Aquaculture production of *Heterobranchus longifilis* has been practised for a long time in Africa. Increased productivity of fry and fingerlings with attributes of faster growth rates and better environmental tolerance, and ensuring fish food security in Africa (Hecht *et al.*, 1982; Nwadukwe, 2003). The use of 17 $\alpha$ -Methyl Testosterone (MT) to induce sex reversal in farmed fish has become a common practice in many parts of the world. MT is a simple and reliable way to produce all-male tilapia stocks, which consistently grow to a larger/more uniform size than mixed sex or all-female stocks. Thus, MT usage in fish farming is expected to continue to increase rapidly as the global demand for large whole tilapia and tilapia fillets grows (FAO, 2006). Exposing fish to different forms of testosterone or estrogen may lead to sex-reversal. Hormones are generally included in the diet for several weeks when the fish start eating. Other hormones have been tested, and sex-reversal has also been achieved by immersion in a solution and producing diseased resistance fish (Obi and Shelton, 1983; Hossain *et al.*, 2022).

There is a need to develop techniques to improve these fish species, because African catfish *Clarias species* and *Heterobranchus species* have larger males that grow faster and are highly demanded as culturable fish in Nigeria. Therefore, the need to improve the growth performance, which breeders find to be an ultimate goal in the hatchery, is essential. This study is designed to determine the effect of sex reversal hormone (17 $\alpha$ -Methyltestosterone) on growth performance and survival rates of *Heterobranchus longifilis* fry.

## MATERIALS AND METHODS

### Study area

The experiment was conducted in the Research Farm of the Department of Fisheries Technology, College of Agriculture Science and Technology, Lafia, Nasarawa State.

### The site location

Lafia is located on latitude 8° 35'N, longitude 8° 32'E, at an altitude of 181.53 m above sea level with a mean

temperature of 34°C, relative humidity of 40-86% and average daylight of 9-12 hours (NIMET 2025).

### Selection, procurement and transportation of broodfish

Mature and gravid brood stocks of *H. longifilis* with the same length of dorsal and adipose fin were purchased from Korlem Fish Farm, Mararaba, Karu, along Rukan Madaki road. The male fish were selected based on large size with a slightly swollen urogenital papilla, which weigh 3.0 kg, and the female fish were selected based on soft, projected abdomen, which extends anteriorly to the pectoral fins.

The brooders were transported from korlem fish farm at 3:00 pm and arrived at 6:45 pm in a 50liter water holding capacity jerrycan. The brood fish were bathed in 0.5% salt solution as an anti-stress and disinfectant, as recommended by Haruna *et al.* (2006), for 5-7 minutes, and were acclimatised for two weeks before use.

### Preparation of experimental diet

At the onset of the experiment, 75 g of 0.2 mm commercial fish feed (Aqua Aller) was procured from Lafia Modern Market. The feed was divided into five equal parts of 15g for the experimental treatments. 20 mg of preserved 17  $\alpha$ -methyltestosterone was obtained from the National Institute for Freshwater Fisheries Research, New Bussa, Niger State, in collaboration with Kingdom Aquariums Limited Showroom, 103, Egbe Road, Ejigbo Road, Lagos, Nigeria.

The androgen powder was dissolved in 75 ml of ethanol. The content was mixed thoroughly by mixing with a spatula for about 5 minutes as described by Macintosh *et al.* (1985). The dissolved hormone was added to the 15 g feed at 1.0, 2.0, 3.0, 4.0 and 0 ml, respectively and was mixed thoroughly with 0.5 ml Cod liver oil purchased from a pharmacy to avoid clumps, and then was left open to dry under room temperature for 24 hours for the ethanol to evaporate.

The dried feeds were labelled as 0ml methyl testosterone as control (MTSR<sub>0</sub>), 1.0 ml methyl testosterone as treatment 1 (MTSR<sub>1</sub>), 2.0 ml methyl testosterone as treatment 2 (MTSR<sub>2</sub>), 3.0 ml methyl testosterone as treatment 3 (MTSR<sub>3</sub>) and 4.0ml as treatment 4 (MTSR<sub>4</sub>), respectively. The feed was administered at 3% body weight to the fry of *Heterobranchus longifilis* for 28 days.

### Administration of hormones for induced breeding

The brood fish were induced using Ovaprim hormone at 0.5 ml per kg body weight according to Woynarovich and

Hovarth (1980). The hormone was injected intramuscularly above the lateral line below the dorsal fin. The fish were kept for 10 hours at 30°C.

### Experimental design

Fifteen sets of 4 litres black bowls were used for raising fry, five treatments in three (3) replicates. 10 fry of the same age (three days), average size (4 mm) was placed in each bowl for 28 days as recommended by Akinwande *et al.* (2011).

### Experimental setup

Three (3) days old fry were distributed and placed in circular plastic bowls and labelled into five (5) treatments in three replicates and nurtured for 28 days in the Fish Hatchery Unit of the farm. The fry was fed as labelled on the plastic bowls, which were MTSR<sub>1</sub>, MTSR<sub>2</sub>, MTSR<sub>3</sub>, MTSR<sub>4</sub> and MTSR<sub>0</sub>. MTSR<sub>0</sub> was the control with 0.0ml of 17  $\alpha$ -methyl testosterone, while MTSR<sub>1</sub> was fed with commercial feed of 0.2 mm incorporated with 1.0ml of 17  $\alpha$ -methyl testosterone. MTSR<sub>2</sub> was incorporated with 2.0 mls of 17  $\alpha$ -methyl testosterone, MTSR<sub>3</sub> was incorporated with 3.0 mls of 17  $\alpha$ -methyl testosterone, while MTSR<sub>4</sub> was incorporated with 4.0 mls of 17  $\alpha$ -methyl testosterone, respectively.

### Formulated feed for continual feeding

Table 1 shows the gross composition of the formulated diet. After 28 days, the fish were fed 2 kg formulated feed containing 40% crude protein for another 56 days. The formulated diet was divided into five equal portions of 400 g each per treatment.

### Data collection

The initial mean weight of the fish was determined by placing the total number of fish (whole) on a Globe Scientific balance to take the average weight (sensitive weighing balance), after which regular sampling for mean weight changes was taken weekly for 8 weeks. The data was collected and processed for growth assessment. The following formula was used to determine the growth performance of the experimental fish.

### Percentage mean weight gain (PWG)

The weight gains of fish in each treatment were taken. All fish per treatment were collectively weighed on a sensitive electronic weighing scale, and the respective weights were recorded.

$$\text{PercentageWeightGain} = \frac{W_f - W_i}{W_i} \times 100$$

Where:  $W_f$  is the final weight, and  $W_i$  is the initial weight.

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Weight of feed given (g)}}{\text{Fish weight gain (g)}} \times 100 \text{ (De Silver and Anderson, 1995)}$$

$$\text{Specific growth rate (SGR)} = \frac{\text{Log}_e W_2 - \text{Log}_e W_1}{t_2 - t_1} \text{ (Brown, 1957)}$$

Where;  $e$  = natural logarithm,  $W_2$  = final weight,  $W_1$  = initial weight,  $t_2$  and  $t_1$  = time duration (days)

### Feed efficiency

Feed efficiency was calculated using the formula below:

$$\text{FeedEfficiency} = \frac{1}{\text{FCR}} \times 100$$

### Survival rate

$$\text{Survival rate \%} = \frac{\text{No of fish survived at the end of experiment}}{\text{Initial number of fish stocked}} \times 100$$

### Sex determination

Sexes were determined through the urogenital papilla for males and the genital papilla for females at the end of the experiment (Ahmed *et al.*, 2015) by direct viewing under a hand lens  $\times 10$ .

### Data analysis

Data obtained was analysed using one way Analysis of variance (ANOVA), SPSS (statistical package computer software 2000 version) and using the methods of Steel *et al.* (1997). Data generated was presented as mean  $\pm$  standard error, and significance was declared.

## RESULTS

Growth performance and survival rate of sex-reversed *Heterobranchus longifilis* is presented in Table 2.

### Mean weight gain

The result revealed that weight gain (g) was highest in MTSR<sub>4</sub>, 246.00 g, followed by 193.00g in MTSR<sub>3</sub>, then 171.00g in MTSR<sub>2</sub>; the least value was recorded in MTSR<sub>0</sub>,

**Table 1.** Gross composition of the formulated diet.

Ingredients (g)	Composition				
	MTSR <sub>1</sub>	MTSR <sub>2</sub>	MTSR <sub>3</sub>	MTSR <sub>4</sub>	MTSR <sub>5</sub>
Maize	56.86	56.86	56.86	56.86	56.86
Rice bran	10.00	10.00	10.00	10.00	10.00
GNC	10.50	10.50	10.50	10.50	10.50
Fish meal	14.25	14.25	14.25	14.25	14.25
Bone meal	2.50	2.50	2.50	2.50	2.50
Vitamin premix	0.60	0.60	0.60	0.60	0.60
Lysine	1.50	1.50	1.50	1.50	1.50
Methionine	1.50	1.50	1.50	1.50	1.50
Vegetable oil	2.00	2.00	2.00	2.00	2.00
Salt	0.29	0.29	0.29	0.29	0.29
Total	100kg	100kg	100kg	100kg	100kg

**Key:** MTSR = methyltestosterone, GNC = Groundnut Cake.

119.00 g, followed by MTSR<sub>1</sub> with 131.00g as the second lowest. The result showed that there was a significant difference ( $p>0.05$ ) in mean weight gain among the treatments.

#### Percentage mean weight gain

Percentage mean weight gain (PMWG) was highest in MTSR<sub>4</sub> (591.10%), followed by 428.90% in MTSR<sub>2</sub>, then 384.30% in MTSR<sub>3</sub>. The least recorded value was recorded in MTSR<sub>0</sub> 264.40%, while MTSR<sub>1</sub> recorded the second lowest value, 293.70%. The result showed that the percentage mean weight gain was significantly different ( $p>0.05$ ) among the treatments.

#### Feed conversion ratio

Feed conversion ratio was highest in MTSR<sub>0</sub>, 2.52, followed by 2.44 in MTSR<sub>1</sub>, then 2.02 in MTSR<sub>2</sub>, with the least recorded value in MTSR<sub>4</sub>, 1.47, with the second least recorded value in MTSR<sub>3</sub>, 1.81. The result showed that there were no significant differences ( $p>0.05$ ) in feed conversion ratio among fish fed diets containing MTSR<sub>1</sub>, MTSR<sub>2</sub>, and MTSR<sub>3</sub>, respectively.

#### Specific growth rate

Specific growth rate was highest in MTSR<sub>4</sub> with a recorded value of 1.84, followed by 1.64 and 1.63 in MTSR<sub>3</sub> and MTSR<sub>2</sub>, respectively. MTSR<sub>0</sub> had the lowest recorded value of 1.39, followed by MTSR<sub>1</sub> at 1.50. The result showed that there was no significant difference ( $p>0.05$ ) in specific growth rate between MTSR<sub>2</sub> and MTSR<sub>3</sub>, while other treatments showed a significant difference.

#### Feed efficiency values

Feed efficiency values were highest, 68.03% MTSR<sub>4</sub>, followed by 55.25% in MTSR<sub>3</sub> and 49.50% and 40.98% in MTSR<sub>2</sub> and MTSR<sub>1</sub>, respectively. The lowest value was recorded in MTSR<sub>0</sub>, 39.68%. The result showed that there was no significant difference ( $p>0.05$ ) between MTSR<sub>1</sub> and MTSR<sub>2</sub>.

#### Survival rate

The result obtained showed that MTSR<sub>4</sub> and MTSR<sub>3</sub> recorded the same values of 66.33 as the highest, followed by MTSR<sub>2</sub> and MTSR<sub>0</sub> with the same value of 60.00, while MTSR<sub>1</sub> recorded the lowest value of 56.67.

#### Sex ratio of *Heterobranchus longifilis* fed experimental diets

Table 3 presents the sex ratio of *Heterobranchus longifilis* fed Experimental Diets. The result showed that MTSR<sub>4</sub> had the highest number of males (17 males), followed by MTSR<sub>3</sub> with 15 males, and MTSR<sub>2</sub> and MTSR<sub>1</sub> with 13 and 10 males, respectively. The lowest number of male fish (9 males) was obtained in MTSR<sub>0</sub>. However, MTSR<sub>0</sub> had the highest number of female fish (9 females), followed by MTSR<sub>1</sub> with 7 females and MTSR<sub>2</sub> with 5 females each. The lowest number of female fish (2 females) was recorded in MTSR<sub>4</sub>.

#### Water quality parameters

Table 4 presents water quality parameters (temperature, dissolved oxygen and pH) of water was recorded from the

**Table 2.** Growth performance and survival rate of sex-reversed *Heterobranchus longifilis*.

Parameters	MTSR <sub>0</sub>	MTSR <sub>1</sub>	MTSR <sub>2</sub>	MTSR <sub>3</sub>	MTSR <sub>4</sub>	SEM	p-value
Initial weight (g)	45.00	44.60	44.50	45.00	45.00	-	-
Final weight (g)	164.00 <sup>e</sup>	175.60 <sup>d</sup>	215.50 <sup>c</sup>	238.00 <sup>b</sup>	311.00 <sup>a</sup>	6.15	0.000
Weight gain (g)	119.00 <sup>e</sup>	131.00 <sup>d</sup>	171.00 <sup>c</sup>	193.00 <sup>b</sup>	246.00 <sup>a</sup>	6.57	0.000
Percentage weight gain (%)	264.40 <sup>e</sup>	293.70 <sup>d</sup>	384.30 <sup>c</sup>	428.90 <sup>b</sup>	591.10 <sup>a</sup>	0.542	0.000
Feed conversion ratio	2.52 <sup>a</sup>	2.44 <sup>a</sup>	2.02 <sup>b</sup>	1.81 <sup>c</sup>	1.47 <sup>d</sup>	0.021	0.000
Specific growth rate	1.39 <sup>d</sup>	1.50 <sup>c</sup>	1.63 <sup>b</sup>	1.64 <sup>b</sup>	1.84 <sup>a</sup>	0.095	0.002
Feed efficiency (%)	39.68 <sup>e</sup>	40.98 <sup>d</sup>	49.50 <sup>c</sup>	55.25 <sup>b</sup>	68.03 <sup>a</sup>	0.088	0.000
Survival Rate (%)	60.00 <sup>b</sup>	56.67 <sup>c</sup>	60.00 <sup>b</sup>	63.33 <sup>a</sup>	63.33 <sup>a</sup>	3.162	0.127

Mean values with different superscript along the row are significantly different ( $p > 0.05$ ).

**Table 3.** Sex ratio of *Heterobranchus longifilis* fed experimental diets.

Treatment	Total No. of fish examined	Male	% Male	Female	%Female
MTSR <sub>0</sub>	18	9	50.00	9	50.00
MTSR <sub>1</sub>	17	10	58.82	7	41.18
MTSR <sub>2</sub>	18	13	72.22	5	27.78
MTSR <sub>3</sub>	19	15	78.95	4	21.05
MTSR <sub>4</sub>	19	17	89.47	2	10.53

MTSR = Methyltestosterone sex reversal.

**Table 4.** Water quality parameters of the culture medium

Parameter	Temperature (°C)	Dissolved Oxygen (mg/l)	pH
MTSR <sub>0</sub>	26.8±0.10 <sup>a</sup>	4.20±0.10 <sup>a</sup>	7.40±0.40 <sup>a</sup>
MTSR <sub>1</sub>	27.8±0.10 <sup>a</sup>	4.50±0.30 <sup>a</sup>	7.56±0.02 <sup>a</sup>
MTSR <sub>2</sub>	26.9±0.00 <sup>a</sup>	4.80±0.01 <sup>a</sup>	7.60±0.10 <sup>a</sup>
MTSR <sub>3</sub>	27.1±0.10 <sup>a</sup>	4.50±0.40 <sup>a</sup>	7.05±0.00 <sup>a</sup>
MTSR <sub>4</sub>	26.9±0.00 <sup>a</sup>	4.80±0.04 <sup>a</sup>	7.56±0.02 <sup>a</sup>

Means with the same superscripts are not significant different ( $p > 0.05$ ) from each other.

experimental tanks, the physical, chemical parameters were within the optimum level required for the culture of *Clarias gariepinus*.

## DISCUSSION

The different growth rate parameters (final weight, weight gain, percentage mean weight gain (PMWG), feed conversion ratio (FCR), specific growth rate (SGR), feed efficiency and survival rate of *H. longifilis* fed diets containing different concentrations of 17 $\alpha$ -methyltestosterone are shown in Table 2. The obtained results in the present study revealed that administration of 17 $\alpha$ -methyltestosterone (MT) induced a significant increase in fish growth of treated *H. longifilis*. The value obtained for percentage weight gain (%) revealed that MTSR<sub>4</sub>, i.e., fry fed diet containing 4.0mls of 17 alpha-

methyl testosterone, had the highest percentage weight gain of 591.10%, followed by MTSR<sub>3</sub> with 428.90% while the lowest percentage weight gain of 264.40% was obtained in MTSR<sub>0</sub> i.e fry fed diet containing 0.0mls of 17 alpha methyl testosterone (control). Based on the results of the study, there were significant differences ( $p > 0.05$ ) among all the treatments. The result of this study is in line with the findings of Dan and Little (2000), who reported an increase in individual growth of sex-reversed Nile tilapia during culture with an increase in concentration of sex reversal hormone. Ahmed *et al.* (2015) also reported similar results in their experiment on sex reversal and growth performances in *Clarias gariepinus* fry fed dietary genistein under laboratory conditions.

The result further showed that an increase in the mean body weight of the fish with respect to time throughout the culture period was observed for both the treatment groups. This indicates that the environmental conditions for fish

growth were favourable in the culture pond, as mentioned by Mohammad (2006). The increase in body weight gain may be attributed to the androgenic steroid enhancer present in the hormone that can induce the feed digestion and absorption rate, causing an increase in body weight (Yakubu *et al.*, 2012; Yamazaki, 1976). The results also indicate that the inclusion of hormones in the fish diet is beneficial for fish growth. These results are in agreement with El-Greisy and El-Gamal (2012) who found that the hormone significantly ( $p < 0.05$ ) increased the final weight of fish (Nile tilapia) as compared to untreated fish. The interaction of both factors affected the growth parameters. Khouraba (1997) reported that 10-60 ppm MT-treatment showed better growth than the control. Hanson *et al.* (1983) observed faster growth in *O. mossambicus* when fed 17 $\alpha$ -methyltestosterone. The increase in fish growth may be because MT administration increased the proteolytic activity of the gut, as is the case in mirror carp, leading to an increase in growth rate (Dan and Little, 2000). Furthermore, MT treatment may stimulate thyroid and internal functions as well as insulin secretion from the pancreatic B cells of fish (Lone and Matty, 1981). Also, androgenic steroids may promote the release of growth hormone from the pituitary somatotropes (Lone and Matty, 1981).

Survival rate may be influenced by the hormone, as observed in this study, as shown in Table 1. The result revealed that there was no significant difference between MTSR<sub>3</sub> and MTSR<sub>4</sub>, likewise MTSR<sub>0</sub> and MTSR<sub>2</sub>, respectively. The result obtained is in line with that of Funda and Sehiban (2007) on masculinization of African catfish treated with Gokshura (*Tribulus terrestris*), where they reported no significant difference among the treatments. The androgen, 17 $\alpha$ -methyltestosterone, was reported to have no deleterious effect on the survival of fish (Vera Cruz and Mair, 1994; Chakraborty *et al.*, 2011). However, the lower survival rate observed in this study (56.67% - 63.33%) could be a result of frequent water exchange practice and handling of fry while cleaning leftover feed. This is in agreement with the findings of Wangpen (1996), who indicated that higher (100%) survival rates could be linked to favourable ecological conditions.

### Sex-ratio

The results of the study demonstrate that it is possible to manipulate the sex in *H. longifilis* by dietary administration of 17  $\alpha$ -methyl testosterone (Table 2). 17 $\alpha$ -methyl testosterone was found to play a significant role in altering the sex of *H. longifilis* into males. Among the four doses of hormone tested, the dose of 4.0mls (MTSR<sub>4</sub>) feed was found to be most potent and resulted in 89.47% male fish compared to 50.00% of male fish in the control group. None of the doses of 17 $\alpha$ -methyl testosterone tested in the present study was found to be effective in producing all male populations of *H. longifilis*.

The number of male fish observed in the sex reversed fish receiving MT showed a greater and significantly higher ( $p < 0.05$ ) male proportion as compared to the control without methyl testosterone. In view of this, the result of the sex ratio is an indication that feeding of 17 $\alpha$ -methyltestosterone (MT) to the fry significantly altered the sex ratio towards male, which exhibits faster growth and arrested reproduction of the cultured fish. This is very obvious in the highest sex occurrence of the male population of 89.47% recorded in MTSR<sub>4</sub> (sex reversed *H. longifilis* fed 4.0mls of 17 $\alpha$ -methyltestosterone). A similar higher sex occurrence of 78.95% male was also recorded in MTSR<sub>3</sub> (sex reversed *H. longifilis* fed 3.0mls of 17 $\alpha$ -methyltestosterone), which was significantly higher ( $p < 0.05$ ) than the control MTSR<sub>0</sub> with sex occurrence of 50.00% males and females, respectively, as shown in Table 2. In the present study, administration of 17 $\alpha$ -methyltestosterone resulted in male dominated population along with some females, which agrees with most of the earlier studies. Jae-Yoon *et al.* (1988) obtained 97% of *O. niloticus* males when applying a dose rate of 10 mg kg<sup>-1</sup> MT of diet. Romerio *et al.* (2000) obtained 98% male population at a dose rate of 60 mg kg<sup>-1</sup> MT of feed. The results of this study showed a significantly higher male proportion (17) for 4.0mls of MT/15g of feed. These results are in line with the findings of Okoko (1996), who obtained higher males at a dose rate of 120 mg kg<sup>-1</sup> MT of feed. Ahmed *et al.* (2015) also obtained a higher number of male *Clarias gariepinus* at higher dosages of genistein as a sex reversal hormone.

### Conclusion

The study clearly showed that it is possible to manipulate the sex ratio of the *H. longifilis* by dietary administration of 17  $\alpha$ -methyltestosterone, inclusion of the steroid hormone and enhanced the growth performance in the sex reversed fish. In this present study, it is apparent that a small proportion of females is still observed. Survival rate of *H. longifilis* may be influenced by administration of 17  $\alpha$ -methyl testosterone for sex reversal. However, the lower survival rate recorded in this study could be a result of frequent handling while cleaning left out feed. The present study demonstrated that a higher dosage of 17  $\alpha$ -methyl testosterone, 4.0 mls/kg and above, can be required for complete (100% monosex male population) sex reversal in *H. longifilis*.

### CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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