



The Effects of Some Physico-Chemical Parameters on the Breeding of Catfish (*Clarias Gariepinus*) using Ovaprim and Ovatide

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Abstract: A comparative assessment of the effects of some physico-chemical parameters on breeding of catfish (*Clarias gariepinus*) using ovaprim and ovatide was investigated from the month of July to August, 2016 in Makurdi, Benue State, Nigeria. Twelve (12) female brooders and six (6) males were obtained from Ocepson's Farm and Aqua-heaven Fish Farm respectively in Makurdi. The doses of 0.8ml/kg, 0.5ml/kg and 0.3ml/kg of ovaprim and 0.3ml/kg, 0.2ml/kg and 0.1ml/kg of ovatide were used. Some physico-chemical parameters such as dissolved oxygen, temperature and pH were monitored during breeding of the fish. The maximum mean temperature of 26.43 °C was observed in 0.3ml/kg dosage of ovaprim while in ovatide, the maximum mean temperature of 26.90 °C was observed in a dosage of 0.1ml/kg. There was no significant difference ($p>0.05$) in the mean temperature amongst all the varying doses of the hormones used. The maximum mean pH of 7.01 was observed in 0.8ml/kg dosage of ovaprim whereas a maximum mean pH of 6.99 was observed in a dosage of 0.3ml/kg of ovatide. There was no significant difference ($p>0.05$) in the mean water pH amongst the varying doses of the hormones used. The minimum and maximum mean incubation period of 20.66±40 and 23.00±25.00 hours respectively were observed in ovaprim. The minimum and maximum mean incubation period of 20.83±38.00 and 22.83 hours respectively were observed in ovatide. There was a significant difference ($p<0.05$) in the mean incubation period of the eggs that were induced with varying doses of ovaprim and ovatide.

Keywords: ovaprim, ovatide, physico-chemical parameters, breeding, *Clarias gariepinus*

1. INTRODUCTION

Physico-chemical parameters of water are known to influence fish breeding. Some of these physico-chemical parameters are known to affect fish breeding either when they are in low, moderate or high states. Among the most prominent physico-chemical parameters that can influence fish breeding include Temperature, Dissolved oxygen and pH. According to Chukwuma and Henry (2012), water hardness does not affect the fertilization of *Clarias gariepinus* but was known to have affected the hatching rate of the fish.

A study conducted by Oyelese (2006) reported that fertilization and hatchability was favoured at higher temperature. According to Amaechi and Solomon (2015), optimum temperature range for fertilization and hatchability was 26-27 °C. The study further stated that the dissolved oxygen level of 5.03mg/l and a pH range of 7.10-8.70 favoured the fertilization and hatchability of *Clarias gariepinus*.

Bhatnagar and Sangwan (2009) reported that dissolved oxygen in the range of 4.5-8.0mg/l was suitable for fish breeding. The importance of water dissolved oxygen was stressed by Bhatnagar and Grag (2000). The study reported that lower level in water oxygen can lead to poor feeding efficiency, starvation, slow growth rate as well as mortality of the fish.

The study conducted by Santhosth and Singh (2007) revealed that fish breeding was suitable at a pH range of 6.7-9.5. The study further revealed that a water pH level above and below the pH range posed stress to the fish strain used.

Whenever a fish farmer or breeder embarks on fish breeding, the aim is to have a good success to produce large number of hatchlings that can grow up to fingerlings and eventually up to table size fish. However, this cannot be achieved unless the breeder knows the most prominent and suitable range of physico-chemical parameters that can be maintained throughout the breeding period why using a given doses of a particular hormone to induce the fish. Hence the need to check the effects of some physico-chemical parameters on breeding of catfish (*Clarias gariepinus*) using ovaprim and ovotide. This will provide baseline information on the most prominent physico-chemical parameters such as temperature, dissolved oxygen and pH as well as their suitable range that can be maintained during breeding of *Clarias gariepinus* using ovaprim and ovotide.

2. MATERIALS AND METHODS

2.1. Study Area

The research was conducted in Toc's Mini Fish Hatchery (A private hatchery situated behind Tilley Gyado College North bank, Makurdi, Nigeria), located on latitude 7.7493N and longitude 8.5508E (Fig. 1).

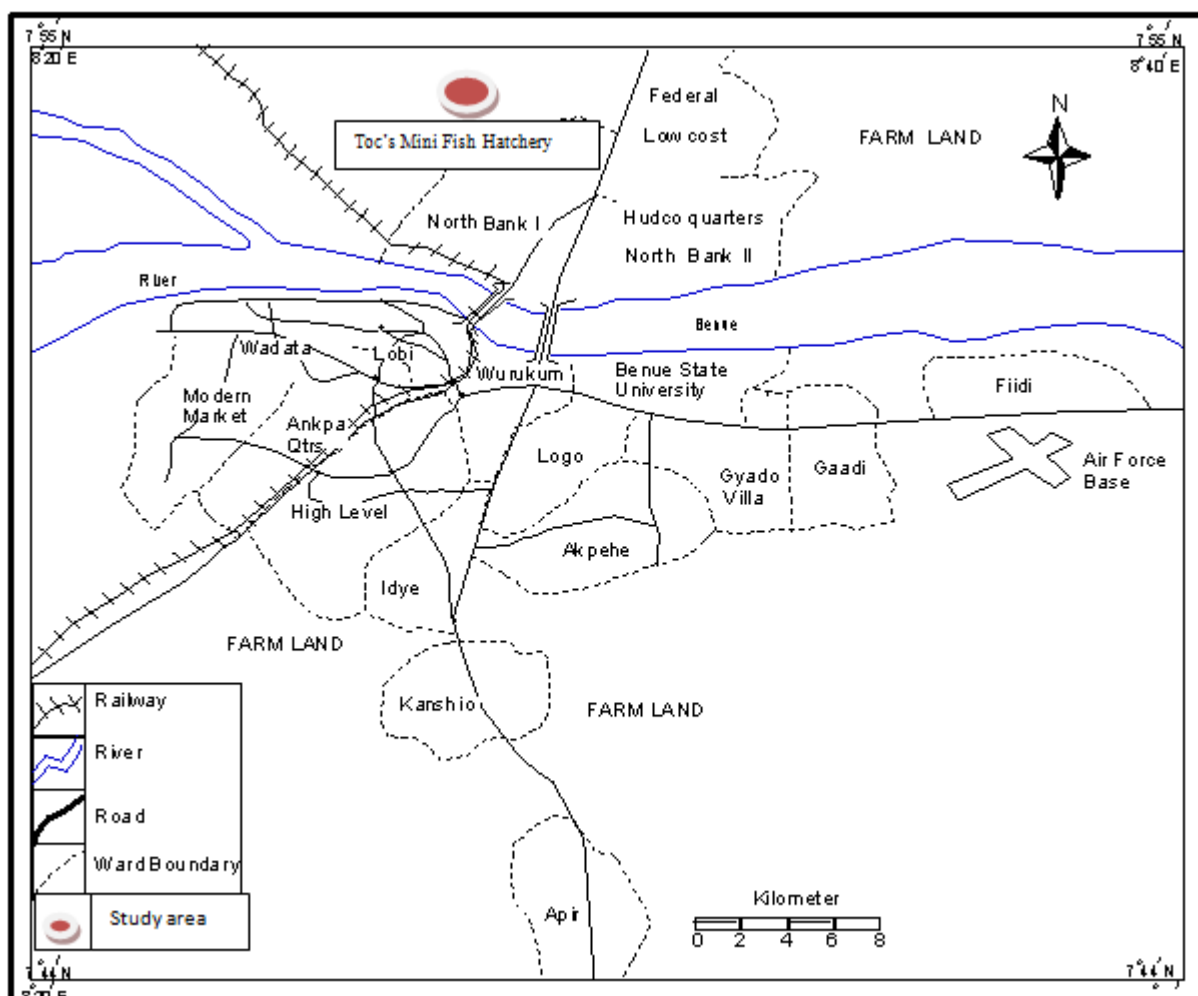


Fig1. Map of Makurdi Showing the Study Area (Source: Google map).

2.2. Brood Stock Procurement and Acclimatization

Thirty (30) healthy brood stocks of the African Catfish *Clarias gariepinus* (20 females and 10 males) were purchased from two different fish farms in Makurdi to avoid inbreeding. The females were gotten from Ocepson's Farm along University of Agriculture road, Makurdi, Benue State, Nigeria, while the males were gotten from Aqua-heaven Farm, North Bank, behind cattle market, Makurdi. All brood stocks were selected by examining their external morphological characteristics. Both males and females were acclimatized in separate earthen ponds of 6 x 6 x 2 meters for 3 weeks during which

they were fed with a formulated diet of 40% crude protein twice daily at 5% of total fish biomass. The fish samples were each weighed with a sensitive electronic weighing balance (Camry Emperors) of 1500g maximum capacity.

2.3. Experimental Design

Twelve (12) females and six (6) males were selected randomly at the ratio of 2:1 with three (3) treatments and three (3) replicates each for ovaprim and ovotide. Ovaprim consisted of Treatment A: 0.8 ml/kg, Treatment B: 0.5 ml/kg, and Treatment C: 0.3 ml/kg. Ovotide consisted of Treatment O: 0.3 ml/kg, Treatment P: 0.2 ml/kg, and Treatment Q: 0.1 ml/kg.

2.4. Selection of Brooders

Twelve (12) female and six (6) male brooders with weight between 1.0kg-1.5kg were selected. A female was considered ripped if the sex organ was reddish and the abdomen was well protruded and eggs ooze out freely when the abdomen was gently pressed antero-posteriorly while the male was considered ripped if the tip of the genital papilla was reddish in colour (Olubiyi *et al.*, 2005)

2.5. Hormone Injection

Selected female brooders were injected using a 1 and 2ml graduated syringe intramuscularly at an angle of 30-45° at the dorsal fin with different doses of ovaprim and ovotide (Viveen *et al.*, 1985). The males were not administered with hormones.

Broods were collected from earthen ponds just prior to injection. A single injection was given to the female from three doses of Ovaprim and Ovotide hormone. The broods were treated with inducing agent at evening so that fish ovulate in the morning. Injection at the interval of 30 minutes to prevent the fish from attaining latency period at once.

2.6. Stripping and Fertilization

The females were stripped by gently pressing the abdomen between 8-11 hours after injecting the fish. This was carried out by holding the fish at head and covering with a wet towel and at the tail. The ovulated eggs were stripped into a dry plastic bowl and 8.5g of eggs were collected from each sample into each labelled bowl for easy identification.

The males of the Catfish were sacrificed to obtain their milt (sperm) by dissecting them with a new razor blade into a dry plastic bowl and washed with 10ml of normal saline to enable gentle movement of sperms, reduces the stickiness of eggs and to prolong the fertilizing capacity of the milt. The eggs obtained from the stripping were weighed, followed by mixing the sperm with eggs and washing the sperm sac in to the eggs carefully for about 30-60 seconds by shaking the plastic plate and adding equivalent volume of clean water to rinse the fertilized eggs.

Thus fecundity was calculated using this formula as described by Brzuska (2003) as follows;

$$\text{Stripping (\%)} = \frac{\text{Weight of stripped eggs}}{\text{Body weight}} \times \frac{100}{1}$$

2.7. Incubation

The fertilized eggs were evenly spread over the nylon mosquito net mesh size of 2 mm and placed in a 10 litres plastic trough containing about 7-8 litres of water.

2.8. Estimate of Percentage Fertilization, Hatchability and Survival Rates of African Catfish *Clarias gariepinus*

After 20-24 hours of fertilization, dead and unviable eggs which had turned whitish were collected after removals of the spawning netting by siphoning and were counted and percentage fertilization was estimated.

The fertilized eggs were counted in other to calculate the percentage fertilization as described by Adebayo and Popola, (2008) as follows;

$$\text{Fertilization (\%)} = \frac{\text{Number of fertilized eggs}}{\text{Total number of counted eggs}} \times \frac{100}{1}$$

Percentage hatchability was calculated after the period of 20-24 hours using a 500ml beaker, where the un-hatched eggs were estimated and this was used to calculate hatchability as described by Haniffa and Sridhar, (2002) as estimated below;

$$\text{Hatchability (\%)} = \frac{\text{Number of hatchlings}}{\text{Total number of eggs counted}} \times \frac{100}{1}$$

2.9. Water Quality Parameters

pH, Temperature (°C) and Dissolved Oxygen (DO) of the water were monitored twice daily using pH meter, Thermometer (check temp °C) and dissolved oxygen meter (DO-5509) respectively.

2.10. Data Analysis

The data of the number of eggs stripped, fertilized, hatched and survival rate of fry were analyzed using Simple percentages and ANOVA, to compare the dosage of Ovaprim and Ovotide using SPSS (Statistical Package for Social Sciences) computer package was used to perform data analysis

3. RESULTS

3.1. Water Quality

The physico-chemical conditions of water during the experiments are shown in the following table, Temperature, pH and dissolved oxygen of water during treatments ranged from 25.06-25.97°C, 7.00-7.01 and 5.78-5.83mgL⁻¹ for ovaprim and 26.85-26.90°C, 6.94-6.99 and 5.71-5.86mgL⁻¹ for ovotide.

3.2. Temperature

Temperature was measured twice daily and there was slight fluctuation during the study period.

The temperature ranges between 25.06-26.43°C in all ovaprim treatments. The maximum mean temperature was observed in 0.3ml doses of ovaprim hormone treated basins during the experimental period. (Fig.1)

In ovotide hormone, the temperature ranges between 26.85-26.90°C in all treatments while the maximum mean temperature was observed in 0.1ml doses of ovotide hormone treated basins during the experimental period (Fig.1).

Table1. *The Fish Weight, Mean Egg Weight, Mean Incubation and Latency Period during the Study.*

Hormone Doses (ml/kg)	Female weight (kg)	Male weight(kg)	Mean egg weight (g)	Mean latency period (hrs)	Mean incubation period (hrs)
			OVAPRIM		
0.8	1.0±0.029 ^a	1.2±0.101 ^a	185.20±0.20 ^a	8.16±10.00 ^a	20.66±40.00 ^a
0.5	1.0±0.031 ^a	1.5±0.203 ^b	166.25±0.25 ^b	11.66±20.00 ^b	23.00±25.00 ^b
0.3	1.0±0.029 ^a	1.2±0.122 ^a	178.30±0.26 ^a	10.00±12.00 ^b	22.66±27.00 ^b
P value	p>0.05	P<0.05	P<0.05	P<0.05	p< 0.05
			OVATIDE		
0.3	1.2±0.019 ^a	1.3±0.100 ^a	162.70±0.24 ^a	8.33±12.500 ^a	20.83±30.00 ^a
0.2	1.0±0.031 ^a	1.5±0.201 ^b	175.60±0.23 ^b	11.50±15.00 ^b	22.83±32.00 ^b
0.1	1.1±0.029 ^a	1.2±0.022 ^a	178.20±0.26 ^b	10.00±11.00 ^b	22.50±38.00 ^b
P value	p>0.05	P<0.05	P<0.05	P<0.05	P<0.05

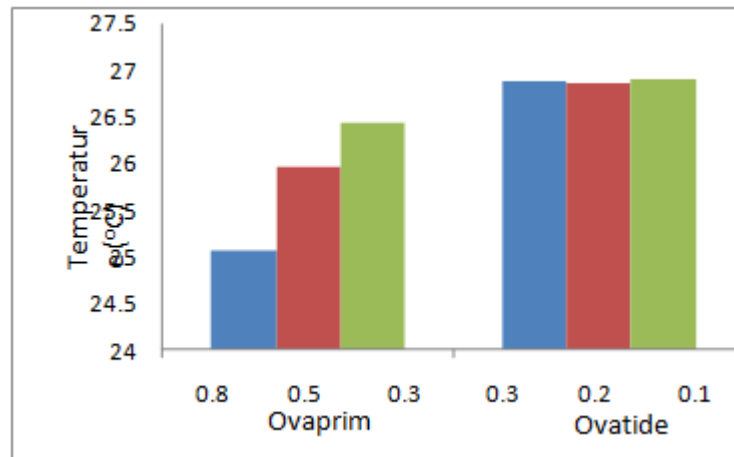


Fig1. Mean Temperature in Ovaprim and Ovotide during the Study

3.3. pH

In ovaprim hormone, the pH value of each treatment basin was in the range between 7.00 - 7.01 in all treatment. There was no significant difference ($p>0.05$) in pH concentration among all treatments during the study periods (Fig. 2).

In ovotide hormone, the pH value of each treatment basin was in the range between 6.94-6.99 in all treatments. There was no significant difference ($p>0.05$) in pH among all treatments during the study periods (Fig. 2).

3.4. Dissolved Oxygen

In ovaprim hormone, the dissolved oxygen (DO) concentration was measured in the range between 5.78-5.83 mg L^{-1} in all treatments. The maximum dissolved oxygen (DO) concentration was 5.83 mgL^{-1} recorded in 0.2ml doses of ovaprim hormone treated basins during the experimental period (Fig. 3).

There was no significant difference ($p>0.05$) in dissolved oxygen concentration among all treatments during the study period. The range of dissolved oxygen observed in this study slightly varied among all treatments.

In ovotide hormone, the dissolved oxygen (DO) concentration was measured in the range between 5.71-5.86 mg L^{-1} in all treatments. The maximum dissolved oxygen (DO) concentration was 5.86 mgL^{-1} recorded in 0.3ml doses of ovotide hormone treated basins during the experimental period (Fig. 3).

There was no significant difference ($p>0.05$) in dissolved oxygen concentration among all treatments during the study periods.

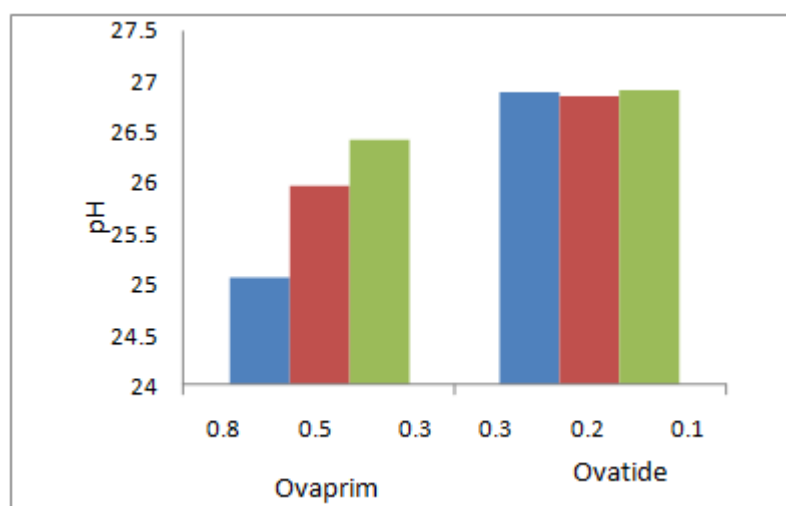


Fig2. Mean pH in Ovaprim and Ovotide during the Study

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Table2. Mean Water Quality Conditions and Latency Temperature of Ovaprim during the Study

Hormone Dose (ml/kg)	DO (mg L ⁻¹)	PH	TEMP (°C)	LATENCY TEMP
OVAPRIM				
0.8	5.7800±0.63 ^a	7.0050±0.01 ^a	25.0575±2.49 ^a	27.7250±0.32 ^a
0.5	5.8200±0.13 ^a	7.0000±0.00 ^a	25.9700±0.16 ^a	27.5325±0.18 ^{ab}
0.3	5.8325±0.13 ^a	7.0000±0.00 ^a	26.4275±0.10 ^a	27.8900±0.24 ^{ac}

P value $p>0.05$ $p>0.05$ $p>0.05$ $p<0.05$

Table3. Mean Water Quality Conditions and Latency Temperature of Ovotide during the Study

Hormone Doses (ml/kg)	DO (mg L ⁻¹)	PH	TEMP. (°C)	LATENCY TEMP
OVATIDE				
0.3	5.8575±0.14 ^a	6.9875±0.03 ^a	26.8825±0.07 ^a	27.4750±0.29 ^a
0.2	5.7125±0.23 ^a	6.9375±0.03 ^a	26.8500±0.04 ^a	26.9900±0.01 ^b
0.1	5.7400±0.19 ^a	6.9625±0.03 ^a	26.9025±0.05 ^a	28.0500±0.00 ^c

P value $p>0.05$ $p>0.05$ $p>0.05$ $p>0.05$

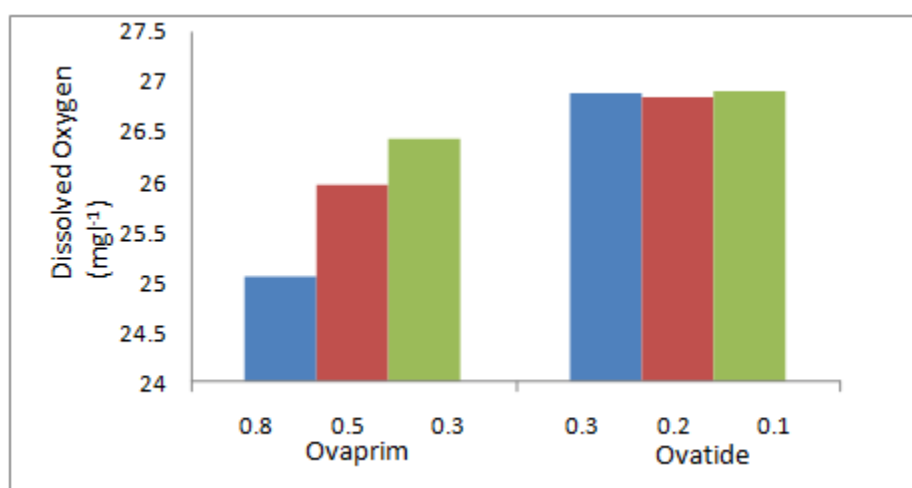


Fig3. Mean Dissolved Oxygen in Ovaprim and Ovotide during the Study

4. DISCUSSION

During the study period, the mean temperature ranged between 25.06-26.43⁰C in incubated eggs that ovulated as a result of inducing the parent stock with varying doses of ovaprim. The maximum mean temperature was observed in 0.3ml/kg dose of ovaprim hormone (Fig. 1). In ovotide hormone, the mean temperature ranged between 26.85-26.90⁰C. The maximum mean temperature was observed in incubated eggs that were ovulated by using 0.1ml/kg of ovotide hormone (Table 2). The differences in the mean temperature in both hormones could be attributed to the quantity of heat absorbed by each egg in each hatchery tank, weather and environmental conditions. There was no significant difference ($p>0.05$) in the mean temperature among all the varying doses of the hormones used. The highest temperature which occurred at 0.3ml/kg in ovaprim hormone had the lowest fertilization and hatchability rates. These results disagreed with the previous study of Oyelese (2006) which stated that at higher temperatures, fertilization and hatchability gave the best results. However, this statement agrees with those trends in ovotide where at higher temperature, fertilization and hatchability rates were at their best. These results agrees with a study conducted by Amaechi and Solomon (2015) which reported that optimum temperature ranges for fertilization and hatchability was between 26-27⁰C. Gomina (2011) reported that the best temperature for fertilization and hatchability was 25.9⁰C and Alemayehu (2015) reported that the best temperature for fertilization and hatchability was between 25.10-26.12⁰C.

The mean water pH of the incubated eggs that were stripped as a result of using varying dosages of ovaprim to stimulate their ovulation ranged between 7.00-7.01 (Fig. 2). The mean water pH of the incubated eggs that were stripped as a result of using varying dosages of ovotide to stimulate their

ovulation ranged between 6.94-6.99 (Fig. 2). The differences in the mean water pH of both hormones could be attributed to the weather and environmental conditions, presence of blood stains on the eggs, fatty content of the eggs and variation in water level of the hatchery tanks used. There was no significant difference ($p>0.05$) in the mean water pH among the varying doses of the hormones used. These results agreed with the work of Santhosth and Singh (2007) which reported that a suitable pH range for fish breeding was between 6.7-9.5. This work is also similar to the work of Kutwal *et al.*, (2015) which reported that a pH of 6.0 favoured the breeding of *Clarias gariepinus* using Carp pituitary extract and ovulin-L. Isa *et al.*, (2015) worked on the effect of monthly variation in water temperature on artificial breeding of common carp (*Cyprinus carpio*) on a pH range of 7.97-8.09. Muhammed *et al.*, (2014) worked on the breeding of *Sperata seenghala* using different hormones such as ovaprim, Human Chorionic Gonadotropin, Leutenizing Releasing Hormone and ovotide on pH range of 7.0-7.5.

The dissolved oxygen of the water in which the eggs that were stripped as a result of using varying dosages of ovaprim were incubated ranged between 5.78-5.83mg/l. The maximum mean dissolved oxygen of 5.83mg/l was recorded in 0.3ml/kg of ovaprim (Fig. 3). On the other hand, the dissolved oxygen of the water in which the eggs that were stripped using varying dosages of ovotide were incubated ranged between 5.71-5.86mg/l. The maximum mean dissolved oxygen of 5.86mg/l in ovotide was recorded in a dose of 0.1ml/kg (Fig. 3). The differences in the mean dissolved oxygen of both hormones could be attributed to differences in the respiration of the incubated eggs, temperature of the hatchery tanks used, the influence of the prevailing atmospheric air pressure during the experiment, and continuous flowing of water in and out of the hatchery tanks. There was no significant difference ($p>0.05$) in the mean dissolved oxygen among all the varying doses of the hormones used. This study agrees with the work of Bhatnagar and Sangwan (2009) which reported that dissolved oxygen in the range of 4.5-8mg/l was suitable for fish breeding. This work is also similar to the findings of Tsadu *et al.*, (2013) on induced breeding of *Clarias anguilaris* with *Xenopus laevis* (African clawed frog) crude pituitary glands at a dissolved oxygen level of 5.6-6.4mg/l. This study disagreed with the work of Ngueku (2015) on the efficacy of synthetic and non-synthetic hormones in the induced spawning of the African catfish at a dissolved oxygen level of 4.70mg/l; Nwudukwe (2013) on the breeding performance of *Heterobranchus bidorsalis* and *Heterobranchus longifilis* using three doses of ovaprim at a dissolved oxygen level of 1.64mg/l and that of Victor *et al.*, (2016) which reported that a dissolved oxygen range of 2.20-5.60mg/l was observed during the study on the effect of water renewal on growth of *Clarias gariepinus* fingerlings.

The minimum and maximum mean incubation period of 20.66±40.00 and 23.00±25.00hours respectively were observed in ovaprim. On the other hand, a minimum and maximum mean incubation period of 20.83±38.00 and 22.83±32.00hours respectively were observed in ovotide (Table 1). There was a significant difference ($p<0.05$) in the mean incubation period (hours) of the eggs that were induced with varying doses of ovaprim and ovotide. The difference in the mean incubation period (hours) could be attributed to the effects of oxygen, temperature, pH and dissolved oxygen during incubation of the eggs and water levels in the hatchery tanks used. These results are in agreement with the work of Ngueke (2015) which reported that the incubation period of African catfish eggs was between 20.00-21.00hours. Similarly, a research conducted by Ayoola *et al.*, (2012) reported a hatching period of 21-26 hours on the eggs of *Clarias gariepinus*. Sharma *et al.*, (2010) reported an incubation period of 46.0 hours, 44.5 hours and 42.5 hours in *Clarias batrachus* injected with 0.8ml/kg, 1.0ml/kg and 0.6ml/kg (doses of ovotide) respectively. The differences in the mean incubation period (hours) obtained from this study with that of others compared could be attributed to environmental conditions and species of the fish used.

5. CONCLUSION

Fertilization and hatchability rates of the eggs of *Clarias gariepinus* were low at higher temperature in eggs that were induced with ovaprim, and on the other hand were at their best in those induced with ovotide. A pH range of 6.94-7.01 observed in this study favoured the fertilization and hatchability rates of the eggs that were induced with both ovaprim and ovotide. The dissolved oxygen range of 5.78-5.83mg/l observed in this study favoured fertilization and hatchability in the eggs that were induced with both varying doses of ovaprim and ovotide. The incubation period (Hours) range of

20.66±40.00-23.00±25.00 hours gave a good hatchability rate in all the eggs that were induced with both varying doses of ovaprim and ovotide.

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