INTRODUCTION

The success of fish farming enterprises is premised by the availability of good quality fish seeds. This is because as the marketable adults are sold out from the farm, young ones are provided to replenish the stock for the sustenance of the business.

Mud catfish is the most sought after fish species among fish farmers and consumers because it commands a very good commercial value in Nigerian markets [1]. In recent past, fish fingerlings are sources from the wild i.e. natural waters however, due to problems associated with wild fish seed, viz. seasonality in availability, uncertainty of species of fish seed collected, disease infestation and limited quality of harvestable fish seed, it is unreliable with respect to sustenance of commercial fish farming [2].

Artificial propagation of fish is the most promising and reliable way of ensuring availability of good quality fish seed all year round and sustainability of the aquaculture industry. It involves the use of natural (hypophysation) or synthetic hormones to induce ovulation and spawning in farmed fishes [3]. As promising as artificial propagation of mud catfish seems, one of the major constraints to fish breeders is the cost of procurement of these hormones. According to Madu [4], hormone input accounts for about 50-60% of total costs for the average fish breeders is used undiluted, thereby increasing the cost of fish production among fish farmers and consumers.

This study which is a pioneer study on the use of diluted ovaprim with normal saline on the induced breeding of Clarias gariepinus is aimed at comparing the effect of various doses of normal saline diluted ovaprim with undiluted ovaprim for use as hormones in induced breeding of Clarias gariepinus. This is to test the effectiveness, efficiency and efficacy of diluting the ovaprim with normal saline to induce the breeding of Clarias gariepinus.

This is in attempt to reduce the cost of ovaprim on fish breeders in the induced breeding of Clarias gariepinus and overall cost of the fish production while at the same time achieving a high spawning, hatchability and survival success of the fish.

Materials and Methods

The study was carried at the laboratory of the Department of Zoology, University of Ilorin, Nigeria.

Brood stock source and management

Twenty-five (25) healthy brood stock of Mud Catfish Clarias gariepinus (Burchell, 1822) (18 females and 7 males) where purchased form Midland Aquaculture Project Limited, Ilorin, Nigeria. All brood fish were selected by external morphological characteristics using the method of Ayinla et al. [11]. Both males and females were acclimatized in separate concrete pond of 8 x 8 x 5 ft for 3 weeks during which they were fed with a formulated diet of 40% crude protein containing fishmeal, toasted soya, groundnut cake, maize, bone meal, lysine methionine and Vitamin premix twice daily 7-9 am and 4-6 pm at 5% of total fish biomass.

Experimental design

Fifteen (15) Spawning trials were carried out in all i.e. five (5) treatments with three (3) replicates of each. The five (5) treatments based on inclusion levels of undiluted generic ovaprim 0%, normal saline diluted ovaprim at 25%, 50%, 75% and 100%, represented as treatments A, B, C, D and E respectively.

Selection of brooder

Saline solution is very cheap solvent (comprising NaCl dissolved in distilled water) in which natural hormones in pituitary are dissolved prior to administration in recipient fish [5,7]. Normal saline which is commonly used form of saline solution is prepared by dissolution of 9 g of NaCl in 1 litre of water [10]. Till now, the expensive ovaprim for the average fish breeders is used undiluted, thereby increasing the cost of fish production among fish farmers and consumers.
Fifteen (15) Female brooders with mean weight of 500 ± 0.35g were selected while 3 males having a mean weight of 2000 ± 0.2g were selected. A female is considered ripe if the abdomen is well distended and eggs oozed out freely when the abdomen was gently pressed anteroposteriorly while the male was considered ripe if the top of the genital papilla was reddish in colour [8].

Hormone injection
Selected female brooders were injected using a 2 ml graduated syringe intramuscularly at an angle of 30-45° at the dorsal fin with 0%, 25%, 50%, 75% and 100% inclusion levels of normal saline. Each injected brooder was secured in different holding trough to prevent them from inflicting injury on one another. The males were not administered with hormones.

Stripping and fertilization
Injected female brooders were removed from their respective troughs after 15 hours (latency period) and stripped into dry bowls and 10 g of eggs were collected from each sample into hitherto labeled bowls for ease of identification. Milt of the male brooders were removed after dissecting them and the sperm collected by laceration of the milt with a clean razor blade into 25 ml of normal saline into a Petri dish. The sperm was then used to fertilize each treatment by mixing both the eggs collected and sperm with a plastic spoon after adding equivalent volume of clean water.

Incubation
Fertilized eggs were then spread on a plastic netting substrate of 2 mm mesh size and placed in a 15 litre plastic trough containing about 10 litres of clean water.

Estimation of percentage fertilization, hatchability and survival
Twenty eight (28) hours after fertilization, dead and unviable eggs which have turned whitish were collected after removal of the plastic netting by siphoning, counted and percentage fertilization was estimated. Percentage hatchability and survival were also calculated at 30 hrs and the fifth (5th) day after hatching respectively using the method of Adebayo and Popoola [12].

Water quality parameters
pH and dissolved oxygen of the water were monitored daily using pH meter and dissolve oxygen meter respectively while mercury in glass thermometer was used to take temperature readings.

Data analysis
Data obtained were pooled for each treatment means and compared by one way ANOVA test to test significant differences (p<0.05) in spawning, hatchability and survival using Duncan’s multiple range test analyzed by SPSS package 2010.

Results
The result of induced breeding of C. gariepinus using the generic undiluted ovaprim as control and four different doses of normal saline diluted ovaprim at 25%, 50%, 75% and 100% is presented in Table 1. Treatment A which is the control showed the highest mean weight of eggs collected than B and C, however there was no significant difference (p<0.05) in the weight of eggs released in the 3 treatments. Spawning or release of eggs did not occur in treatments D and E. After fertilization of the spawned eggs in the treatments, the percentage fertilization of eggs in treatment A was higher than in B and C. However treatment C showed a significant difference (p<0.05) in percentage fertilization as compared to treatments A and B. Similarly, the values of percentage hatchability from the fertilized eggs showed that treatment C has a relatively higher value than treatments A and B, however there was no significant difference(p<0.05) in hatchability of the three treatments. The means of percentage survival of fry was also relatively higher in treatment C than in A and B but there was no significant difference (p<0.05) among the 3 treatments (Table 2).

The cost benefit analysis of the experiment is shown in Table 3. As the rate of dilution of ovaprim with normal saline increases, the cost of hormone per brood stock decreases. Also the number of fry produced per ml of hormone increases. Treatment C showed the cheapest cost with small amount of hormone used per milliliter.

| Treatments | Mean Wt before stripping (g) | Mean wt after stripping (g) | Mean wt loss (g) | Mean Temp at Hatching (°C) | Mean pH | Mean D.O | Latency Period (hrs) |
|------------|-----------------------------|-----------------------------|-----------------|---------------------------|--------|---------|---------------------|
| A          | 500.35                      | 483.15                      | 17.50           | 27.50                     | 0.058  | 0.104   | 11.30               |
| B          | 499.73                      | 482.23                      | 17.50           | 27.50                     | 0.058  | 0.104   | 13.45               |
| C          | 500.30                      | 483.05                      | 17.25           | 27.50                     | 0.058  | 0.104   | 27.50               |
| D          | 501.35                      | 501.35                      | 0.00            | -                         | -      | -       | -                   |
| E          | 500.00                      | 500.00                      | 0.00            | -                         | -      | -       | -                   |

Values with same superscript in the column do not differ significantly (p < 0.05)

| Treatments | Mean Qty of Fry produced / ml of Hormone | Cost per Fry (N) |
|------------|-----------------------------------------|------------------|
| A          | 125                                     | 1208             |
| B          | 93.75                                   | 1119             |
| C          | 62.50                                   | 1074             |

1ml of ovaprim = N500
N = Naira (Unit of Nigeria currency )

Table 3: Cost benefit analysis of fry production per ml of ovaprim in each treatment.

Discussion
Mean weight of eggs collected from the brooders showed that normal saline diluted ovaprim at 75% and 50% is effective in induced breeding of Clarias gariepinus. It should also be noted that latency period varies directly with level of dilution of normal saline and this could be the reason why hatching does not occur at all in treatments D and E. This scenario has already been reported by Shepherd and Bromage [2]. The hatchability rate recorded in the experiment was similar to results obtained by Obiubii et al. [8], where he examined the effects of various doses of ovaprim on reproductive performance of Clarias gariepinus. This work however showed that diluting generic ovaprim with normal saline at 75% and 50% could also result in the production and hatchability of eggs as well as survival of fry which compared well with undiluted ovaprim. Thus, it shows that normal saline could enhance the production, hatchability of eggs and survival of fry. The percentage survival was however relatively lower compared to results obtained by Nwokoye et al. [5], and this could be attributable to the size of the receptacle (tank) in which the eggs were incubated.
experiment was conducted which was relatively smaller and also more eggs were fertilized and the tank was not power-aerated. The high hatchability and survival recorded in treatment C was due to the high effects of physicochemical parameters such as high concentration of dissolved oxygen \cite{9,13,14}. Comparing the costs in the 3 treatments, it is evident that treatment C with 50% inclusion of normal saline diluted ovaprim is highly cost effective, reducing the cost of the hormone used by half.

**CONCLUSION**

From the research, normal saline diluted ovaprim at 50% inclusion level will induce breeding in *Clarias gariepinus* with similar effectiveness, efficiency and efficacy comparable to generic ovaprim. With this, 50% of the cost incurred on the hormone can be saved without having to jeopardize its performance with respect to induce breeding of *Clarias gariepinus*. This will reduce the cost to farmers as well as ensuring a high production of *C. gariepinus* more at an affordable cost.

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