Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.3, No.9, 2013

Comparative Studies on The Hatchability, Performance and Survival Rate of African Catfish (*Clarias gariepinus*) Larval Produced: Using Ovaprim and Catfish Pituitary Extract Hormones

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Abstract
The study was conducted to compare the hatchability and survival rate of fries produced, using ova prim and African cat fish pituitary extract during hypophysation. The costs of hormones were also evaluated. The pituitary glands were extracted from four males. The females were injected intramuscularly with ova prim and pituitary suspension respectively. The fish were randomly selected into the tanks at the ratio of 4 males: 4 females. All other conditions throughout the period of the experiment were the same across the treatments.
Hatching and latency periods were 48hours and 9.05 hours respectively for each of the female across the treatments The female fish injected with ova prim had higher percentage hatchability (46.3%) compared with those injected with African catfish pituitary extract –ACPE (25.99%). The survival rate however showed a contrasting pattern to percentage hatchability. The survival rate was higher in female treated with ACPE (82.98%) and lower in female fish treated with ova prim (50.14%). Higher production cost was significantly ($p<0.05$)) incurred in ACPE compared with ova prim. In the same vein, ACPE had higher gross profit (₦ 68,060) and ova prim treated females had lower value (₦ 42,485.24). The results showed that both ACPE and ova prim aided spawning in African cat fish although, female fish treated with ova prim enhanced higher hatchability however, fingerlings produced from female fish treated with ACPE preformed excellently well in terms of survival and enhanced higher profitability. Therefore, it can be concluded that ACPE hormone yield the best results in hypophysation .
Key words: hatchability, hormones, hypophysation, larva , survival

Introduction

The success of any fish farming operation depends on the availability of a ready supply of fish larvae for on-growing to market size (Rottmann *et al.,* 2003). The rearing of the larvae to the fry stage is most critical in the cycle of fish seed production in hatcheries, therefore, the rearing of the larvae under controlled hatchery condition requires the development of specific culture techniques.
Reproduction technique is one of the factors that affect the performance of any fish farm as it can either be natural or artificial. The output of natural propagation in fish is very low and cannot meet the protein requirement of its consumers (FAO,1996).In view of this an artificial propagation techniques under more controlled conditions has been discovered to produce reliable sources of fish fries and fingerlings distribution centre (FAO,1996).
Artificial breeding otherwise known as hypophysation is practiced with the involvement of reproductive hormones. Induced breeding through hormone treatment and artificial incubation of fertilized egg has advantages of better rate of fertilization and hatching, better conditions for growth and survival of larvae to fingerling and better protection of larvae against unfavourable environmental condition and predators (Woynarovich and Horvath, 1980).
However, most of the hormones that are generally used for induced breeding are deficient in various ways, such as Deoxycorticosteroid Acetate (DOCA) causes severe ulcer on the injected female; Human Chronic Gonadotropin (HCG) is very expensive; Common carp *(Cyprinus carpio)* pituitary gland material are not easily accessible to small scale fish farmers, although Ovaprim (Salmon Gonadotropin Releasing Hormone) had recorded numbers of success but the price is very high.
The report by Hill *et al*. (2009) revealed average success rates of 50% ovulation, 54% spermiation and 1.3% mortality were recorded after injection of different species with ovaprim. Also, ovaprim has been used successfully for hypophysation in different families of fish like cyprinidae (Hill *et al.*, 2005), Characidae and Cobitiidae (Yanong *et al.*, 2009).
However, the price of ovaprim increased indiscriminately due to import duties, therefore, to reduce the cost of production arising from purpose of ovaprim, there is need to find an alternative cheaper spawning aid.
African Catfish pituitary hormone (a non - synthetic hormone) is said to be readily available and cheaper than any other hormone (Adebayo and Popoola, 2008) and can be prepared in a suspension (Fagbenro *et al.*, 1991).

This study therefore examine and compare the response, effect and cost effectiveness of ovaprim and Catfish pituitary hormones on the African Catfish (*Clarias gariepinus*) by determining the hatchability and survival rate(s) of fries produced by hypophysation.

2. Materials and methods

2.1Experimental site EXPERIMENTAL SITE

The Research work was carried out at the fishery unit of Ladoke Akintola University of Technology (LAUTECH) Teaching and Research Farm.

HATCHERY UNIT

Re-circulatory System - This is a system of strict monitoring with controlled environmental factors like water temperature and pH etc. The management practice is for incubating eggs and rearing larvae.

Pump Tank-Water going out from the outlet of the sedimentation tank enters into the pump tank and with the help of pumping machine is recycled back into the rearing tank.

Rearing Tank-This tank harbour the eggs and the newly produced larva throughout the course if the experiment.

Sedimentation Tank-The water going out from the outlet of the rearing tank flow through to the sedimentation tank.

Bio-filter-This was used to remove dirts, residues and faeces of the fish

Experimental fish

Twenty (20) African Catfish brood stock of average weight+/- 1.16kg at the ratio of 12:8 males to females respectively were purchased from a reputable fish farm. They were weighed, acclimatized and fastened for 24 hours prior to the time of usage.

HORMONE PEPARATION

Ovaprim- **I**t does not require any special preparation. It is a commercial product that contains a salmon gonadotropin releasing hormone analog and domperidone which helps to block the inhibitory effect of dopamine (Hill *et al.*, 2009). It was used to aid spawning in the reproductively matured female Catfish. Ovaprim is marketed in liquid form and administered at the dosage of 0.5ml per Kg of each test animals.

EXTRACTION AND PREPARATION OF PITUITARY SUSPENSION

Four (4) out of the males was sacrificed and the head region was cut vertically down. The lower soft part and other succulent part were removed through the use of a cutter. The brain compartment was then opened towards the ventral side and the pituitary gland was extracted through the use of a sterilized needle.

The pituitary gland was crushed and 0.9% saline solution was added to it to make the pituitary suspension.

EXPERIMENTAL PROCEDURE

The female fish were injected with ovaprim and pituitary suspension, 1ml of pituitary suspension (dosage) was administered per Kg of each test animals as recommended by Adebayo and Popoola, 2008.

The hormones were administered respectively at the ratio of 4:4, intramuscularly,a little distance from the head down, after which the treated fishes were returned back into their containers and covered tightly. After 9 - 12hours of injection, the final maturation and ovulation rate was reached and the eggs were stripped out of the female fish by applying gentle pressure on the abdomen of the female fish. Eight males were scarified, their bellies dissected vertically and the testis were removed. Blood and other stains were removed from the testis and the milt were squeezed out. Milt was spread over the stripped eggs and the whole content was mixed together to effect fertilization. After five minutes, the eggs were rinsed with saline solution (0.9% saline solution was prepared by dissolving 9g of common salt in 1litre of water (FAO, 1996).) to remove used sperm and were then spread on nets of 1mm gauge inside the aerated incubator in the hatchery. Every other conditions of the incubator were strictly controlled.

Immediately after fertilization occurs, new development commenced, the eggs absorbed water, sticked to the net. Also, red spot were observed on the green colour of the eggs indicating life.

Healthy developing eggs were transparent green-brownish in colour while the white coloured eggs are those that were not hatched.

Hatching commenced at around the 20^{th} hour and continued till the 48^{th} hour after fertilization. The newly hatched fries escaped through the 1mm gauge into the vat underneath while the unhatched eggs remain on the net.

FRIES MANAGEMENT

To prevent water pollution, un hatched eggs were removed from the incubator by siphoning.. Feeding commences on the 4^{th} day after their yolk sac have been completely absorbed. They were fed with small quantity of processed *Artemia salina ad libitum.* Excess feed and waste were siphoned out using 1mm diameter hose.

WATER QUALITY MANAGEMENT

Since water is used for culture, its quality deteriorates rapidly and therefore needs intensive maintenance. The water once polluted was let out and replaced with clean ones to allow aeration. Water quality is being affected by

temperature, pH value, dissolved oxygen, ammonium level etc.
Temperature - Environmental and water temperature affects hatching in general. With higher temperature, stripping and hatching are achieved more easily and faster than at lower temperature (Hogendoorn *et al.*, 1980). Temperature was raised artificially using heater, bulb and coal gas.
pH value - pH metre was used to measure the pH value of the hatchery water and the sodium sulfite stock solution. pH was controlled by adding either acid or base.
Dissolved Oxygen -Level of dissolved oxygen was improved through the use of an aerator and through constant water replacement.
Ammonia Level - Excess feeding was avoided as they can dissolve to form ammonia which is toxic and harmful to the fishes.
EGG COUNTING-using SODIUM SULFITE AND SALINE SOLUTION

15g of sodium sulfite was weighed and dissolved in 100ml of distilled water making up the concentrated stock solution needed. The stock solution was then diluted with 900ml of hatchery water (Larry, 1977). A certain volume of the sodium sulfite solution was used to separate the cluster spawned eggs.

DATA COLLECTION

Data on number of stripped eggs, number of hatched eggs, number of mortalities, body length of fries were collected and the following were calculated.
Hatchability: No of hatched eggs/ No of eggs weighed x 100%
Survival rate: No of surviving fries/ total number of hatched eggs x 100%
Relative fecundity: Total number of eggs/ body weight
COST EVALUATION - The cost of production of both the natural and synthetic hormone was calculated from:
Cost of production using Ovaprim = cost of hormone (ml) used for injection + cost of breeder + cost of feeding
Cost of production using pituitary gland = cost of donor + cost of breeder + cost of feeding
Net production = Survival at the end of the experiment

STATISTICAL ANALYSIS

The data collected were analyzed using student t – test.

3. Results

Table 1 shows the result of induced *Clarias gariepinus* with ovaprim and African Catfish Pituitary Extract (ACPE). The Average Body Weight (ABW) of breeders across the treatments was the same (1160g).
The mean egg weight (MEW) across the treatments were significantly different ($P< 0.05$) and was highest in *C. gariepinus* injected with ACPE. The total number of eggs shows similar pattern to mean egg weight being highest in *C. gariepinus* injected ACPE.

The relative fecundity across the treatments was significantly different ($P< 0.05$) and breeders injected with ACPE had the highest value.

The percentage hatchability was highest in *C gariepinus* injected with ovaprim (46.3%) compared to breeders injected with ACPE (25.99%).

However the survival rate shows a contrasting pattern to percentage hatchability. It was highest in ACPE treated females (82.98%) and lowest in ovaprim treated females (50.14%).
The hatching and latency period were 48hrs and 9.05hours respectively for each of the treatment at a constant temperature of 27^0C.

Table 2 shows the economic performance of ovaprim and African Catfish Pituitary Extract (ACPE).
The evaluation was based on cost of production, value of fish, profit index and incidence of cost for all treatments. This economic evaluation revealed that hormone sources have highly significant effects on net production of *Clarias gariepinus*.

The overall production was highest in ACPE (2752 fries) and lowest in ovaprim (1785 fries). Cost of production was significantly different ($P< 0.05$) across the treatment been highest in ACPE (₦ 14,500) and lowest in ovaprim (₦11,064.76).

The value of fingerlings also shows similar pattern to cost of production and was highest in ACPE (₦82,560) and lowest in ovaprim (₦53,550) .
The gross profit across the treatments was significantly different ($P< 0.05$). ACPE had highest value of ₦68,060 and Ovaprim had lowest value of ₦42,485.24.

The profit index and incidence of cost were significantly different across the treatments.

Table 3 shows the body length of fries for 28days. The average body lengths of fries produced were different across the treatments from week 1 down to week 4.

Table 4 shows the body weight (g) of fries for 4weeks. It follows the same trend as the body length with ACPE having higher value than ovaprim.

4.Discussion

The study observed the spawning and hatching of fries in fishes treated with ovaprim and African Catfish Pituitary Extract (ACPE). It also shows the survival rates of these fries for period of 4 weeks.

Weight of gravid female fish used in each treatment ranged from 1150g -1170g (average weight of 1160g). All the female fish responded well to hormone (both natural and synthetic) the spawning occurred within 9- 9.08 hrs after injection at a constant temperature of 27^0C.

The study showed the success of hypophysation in *Clarias gariepinus.* The hatching rate was 46.3% in ovaprim and 25.99% in ACPE. These values agreed with Saidin (1986) who reported that artificial oviposition by stripping of *C. macrocephalus* gave low hatching rate of 10- 45%. However, the values are lower than those reported by Adebayo *et al. (*2008) whose hatching rates ranged between 51.1% – 73% in the different hormone treatments.

Generally, values obtained for the spawning response in the hormone treatments were significantly different ($P<0.05$). The mean egg weight were significantly different ($P<0.05$) despite the fact that body weight of the females were approximately the same. However, the injection induced ovulation in all the female Catfishes at the specified dosage.

Yolk absorption was faster in fries produced from ACPE and was completed after 3days. This was not so for fries produced from ovaprim as yolk absorption took about 5days to be completed. Faster growth rate was also observed in ACPE after feeding commenced.

Survival rate of fries after 4 weeks was 50.14% in ovaprim and 82.98% in ACPE. This was in accordance with Adebayo *et al.* (2008) who observed survival rate of greater than 60% after 30 days of rearing.

Cost of production using ACPE was higher than cost of production using ovaprim. This follows the same pattern as reported by Adebayo *et al.* (2008). However the surviving fries at the end of the research counter the effect of high cost of production using ACPE and this eventually resulted into increased overall profit in ACPE. The increased net production of fries from ACPE can be attributed to its increase in total number of eggs. The total number of eggs in ACPE treated females was 90,861 while that of Ovaprim treated female was 35,901.50.

Conclusion

This research showed that greatest profit was realized from female fish injected with non synthetic hormones (ACPE).

Since the main goal of any fish farming enterprise is to maximize profit, it can be concluded that African Catfish pituitary extract should be used to aid spawning in African Catfish.

Recommendation

It is suggested that fish seed production can be encouraged through the use of natural hormone (ACPE) which is more readily available un like ova prim whose supply varies with changes in import duties.

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Table 1: Induced ovulation and spawning of *Clarias gariepinus* using synthetic (ovaprim) and non synthetic (African Catfish Pituitary Extract) hormones.

PARAMETERS	HORMONES		SEM
	Ovaprim	ACPE	
ABW(g)	1160.00	1160.00	0.01
MEW(g)	116.75[b]	177.98[a]	0.11
TNE (g)	35901.50[b]	90861.00[a]	32.46
Relative fecundity	30.95[b]	78.33[a]	0.19
Hatchability (%)	46.30[a]	25.99[b]	1.01
Survival (%)	50.14[b]	82.89[a]	0.04
Hatching periods (hrs)	48.00	48.00	0.00
Latency (hrs)	9.05	9.05	0.03

Means in the same row with different superscripts (a,b) are significantly different (P< 0.05)
ABW: Average body weight,MEW: Mean egg weight,SEM : standard error of mean
TNE ; Total number of eggs, ACPE : African Catfish Pituitary Extract

Table 2: Economic performance of Ovaprim and African Catfish Pituitary Extract (ACPE)

	Hormones		
Parameters	OVAPRIM	ACPE	SEM
Net production*	1785.00[b]	2752.00[a]	0.71
Cost of production (₦)	11,064.76[b]	14,500.00[a]	0.81
Value of fingerlings (₦)	53,550.00[b]	82,560.00[a]	1.78
Gross profit (₦)	42,485.24[b]	68,060.00[a]	0.75
Profit index	46.06[a]	20.64[b]	0.02
Incidence of cost	0.65[b]	1.45[a]	0.01

Means in the same row with different superscripts [(a,b)] are significantly different
*- Surviving fries at the end of the experiment, SEM: Standard Error of Mean
ACPE: African Catfish Pituitary Extract

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