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COMPARATIVE EFFECT AND ECONOMIC ANALYSIS OF PITUITARY EXTRACTS AND SYNTHETIC HORMONE (Ovaprim) ON THE HATCHABILITY AND SURVIVAL RATE OF AFRICAN CATFISH (*Clariasgariepinus*) FRY.

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ABSTRACT

A comparative study was conducted to access the effects and economics analyses of non-synthetic hormone (Pituitary extract) and synthetic hormone (Ovaprim) on latency period, hatchability, survival rate ofClariasgariepinusfry. Two females brood stock with average body weight of 745 g were separately injected with 0.37 ml of ovaprim at the cost of #870 and the second female with 0.75 ml of pituitary extract at the cost of #1,504. They were allowed to go through latency period at temperature of 27^{o}C. The result of the latency period showed significant different ($p>0.05$) as ovaprim had latency period of 656.67±30.53 minutes and pituitary extract had 729.67±17.67 minutes. There was also significant difference($p>0.05$) in percentage hatchability in which 57.72±0.70% and 65.81±0.85% recorded respectively for pituitary extract and ovaprim. There was significant difference in the survival rate of the fry with record of 64.83±0.76% for ovaprim and 58±1.0% for pituitary extract. Cost benefit analysis showed that it cost #31.183 to induce Clariasgariepinusto produce 1 gram of egg using ovaprim and #51.503 to produce 1 gram of egg with pituitary extract. It is thus concluded that

ovaprim is superior to pituitary extract in induction of Clariasgariepinusin artificial breeding and ovaprim is recommended for use because of the derived benefits and conveniences.

Key words: Pituitary Extract, Ovaprim, Hatchability, Survival, Economic

1.0 INTRODUCTION

In recent years, there has been a global attention on aquaculture as an important source of food, income and livelihoods for hundreds of millions of people around the world. According to FAO (2016), aquaculture is the fastest growing food production sector and an important component in many poverty alleviation and food security programme. Aquaculture provided only 7% of fish for human consumption in 1974 and increased to 26% in 1994 and to 39% in 2004 (FAO, 2014).

Global attentions have been shifted on Aquaculture because of the need to augment fish production to meet the demand of the growing people resulting from low sustainable yield from the wild (Owodeinde*et al*., 2011).

In 2014, the aquaculture sector's contribution to the supply of global fish production overtook production from wild sector for the first time. Although total catch from capture fisheries (93.4 million tons) exceeded the production from aquaculture (73.8m tons) of the 146.3 million tons for human consumption, aquaculture's contribution exceeded the supply from wild fish (FAO, 2016).

Another reason for the global attention on aquaculture is the result of awareness of gain derived from eaten fish being the cheapest source of animal protein withless cholesterol then red meat. These reasons among others had made the demand for fish to increase accounting for the challenge of low supply in the sector. The production from aquaculture couldn't meet the demand and from wild became overexploited (Ngueka, 2015).
Fish provides not only high-value protein but also a wide range of essential micronutrients, including various vitamins and mineral as well as polyunsaturated omega-3 fatty acid (docosahexaenoic acid and eicosapentaenoic acid) (FAO, 2012).

Fish accounted for 16.7% of the global population intake of animal protein and 6.5% of all protein consumed in 2010 (FO, 2014) and about 17% of the global populations intake of animal protein and 6.7% of all protein consumed in 2013 (FAO, 2016).

Aquaculture has been growing at about 25-33% per year since 2003 in Nigeria. This is evident in the level of intensity of catfish farming activity, which currently account for approximately 25% of the 110, 000 tons of catfish consumed in the country annually (NADP, 2011). However, a major challenge is the availability of quality fish seed for aquaculture production. A dependable source of quality fish seed (fingerlings) is a fundamental pre-requisite for large scale development of fish culture. The scarcity of fish seed is a major factor that affects all attempts to culture fish.

Among all, African catfish are important to the sustainability of the aquaculture industry of Africa, especially in Nigeria. Their method of propagation is well documented and understood but fingerlings and fry supply still out strips fish farmers demand (Ataguba*et al*., 2013). Induced breeding of African catfish (*Clariasgariepinus*) by using synthetic or non-synthetic hormone ensure availability of matured quality eggs and high survival rate of larval for commercial fish farming (Sebastian, 2018). However, most of the hormones generally used for induced breeding are deficient in various ways, such as Deoxycorticosteriod Acetate (DOCA) causes severe ulcer in the injected female; Human Chronic Gonadotropin (HCG) is very expensive; common carp (*Cyprinuscarpio*) pituitary gland material are not easily accessible to small scale farmer, although ovaprim (Salmon Gonadrotropin Releasing Hormone) had recorded numbers of success but the price is very high (Olaniyi and Akinbola, 2013).

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 or synthetic hormones to induce ovulation and spawning in farmed fishes (Olumuyi and Mustapha, 2012). However, the major constrains to the use of hormones are the cost and availability. Kutwal*et al*. (2017) reported that the cost of synthetic hormones is very expensive and getting carp pituitary extract is tedious, laborious and time consuming. According to Adebayo and Popoola (2012), African catfish pituitary hormone (a non-synthetic hormone) is said to be readily available and cheaper than any other hormone and can be prepared in a suspension. Hence there is need to find alternative sources which are cheaper, effective and readily available as the proper utilization and economic use of available resources in fish production is an added value to the function of profitability, that is more profitable to the fish farmer at low cost of production (Ngeleku, 2015).

2.0 MATERIALS AND METHODS

2.1 Study Location

The study was carried out at the hatchery unit of the Department of Fisheries and Aquaculture Research Farm, Kogi State University Anyigba, Kogi State, located at 7^{o}28’ 45.7’’N and 7^{o}11’ 54.2’’E. Anyigba is located within Guinea Savannah, middle belt zones of Nigeria, The distribution of trees, grasses and other things in the area is determined by factors such as; fire, demographic pressure, patterns of cultivation, clearing and relief. Trees found in Anyigba do adapt to dry conditions (deciduous) and they shed their leaves in the dry season to control evapotranspiration (Ifatimehin*et al*., 2012).

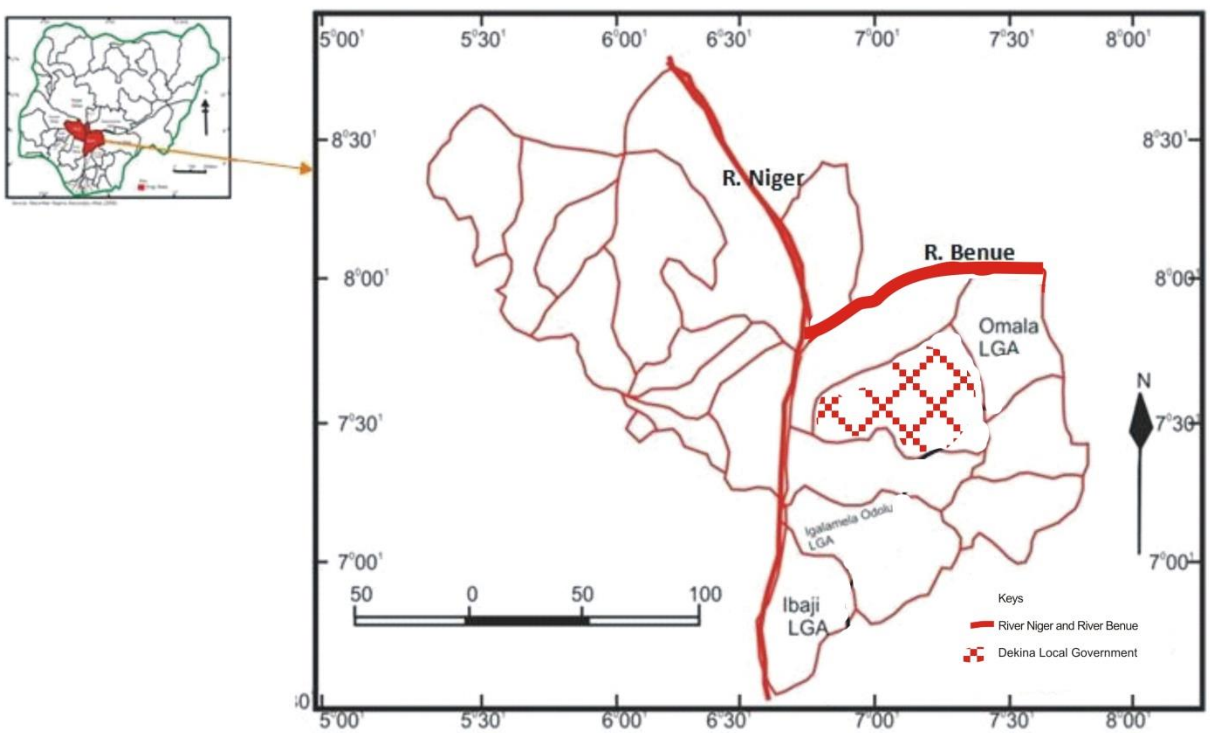

Fig.1: Map of Nigeria showing Kogi State and Dekina Local Government Area. Source: Department of Geography and Environmental Science, Kogi State University, Anyigba.

2.2 Selection and Collection of Brood Stocks

Five Broodstocks (two females average weight of 745g) purchased from Spirit Fish Farm Okura Kogi State and (three males average weight of 752g) were purchased from Food way integrated Farm Lokoja, Kogi State. The matured gravid females were selected based on observation of well distended swollen soft abdomen reddish vent and gently extraction of few eggs by slightly pressing the abdomen manually with fingers toward the genital papilla for the visual observation of viability and maturity of the eggs. Matured males were selected based on the observation of elongated, genital papilla with reddish pointed tip. They were weighed separately using Top Load weighing balance.

2.3 Collection of Pituitary Extract (Natural hormone)

The natural hormone (Pituitary extract) were collected from one male broodstock by cutting the head off, turned upside down with the lower jaw facing upward then cut through the mouth which exposed the skull internally. The skull was then broken internally to obtained the pituitary which was found as small oval shaped organ, pinkish-white, situated at the vent part of the brain (selleturica) (Abdul *et al*., 2017). The pituitary was removed using forcep into alcohol to remove the stain of blood. This was prepared by grinding in a laboratory mortar. Hydrosaline solution (0.9% normal saline) was added and mixed thoroughly before administration.

2.4 Collection of Synthetic Hormone (Ovaprim)

The synthetic hormone (Ovaprim) produced by Syndell laboratories, Canada in 10 ml bottle was purchased from Achenyo Fish Shop Lokoja, Kogi State and this was kept in a cool environment before administration.

2.5 Administration of Hormone

The ovaprim (synthetic hormone) was administered intramuscularly (above lateral line, 45^o toward the head region) at recommended dosage of 0.5ml per kg body weight of female fish. The pituitary gland extract was administered intramuscularly (above the lateral line 45^o toward the head region) at dosage of 1ml per kg body weight of the female fish (Abdul *et al*., 2017). Both females induced were kept in separate plastic basin of 40 liter capacity and filled with 30 liters of water. The containers were covered with 2cm mesh size fish nets to avoid jumping out of the container.

2.6 Milt and Eggs Collection

The milt was collected by sacrificing one of the male. The abdomen was dissected ventrally and the two lobes of testes removed, cleaned with tissue paper to remove the blood stain. The testes were then cut open with razor blade and the milt squeezed out, hydrosaline solution added to increase the surface area, and for preservation of the milt.The latency period of the females lasted for about 9 hours at temperature of 27^o C and were stripped of their eggs by applying slight pressure on the abdomen to release the egg. The eggs were collected in a dry well cleaned plastic bowl and weighed on a sensitive scale to determine the number of eggs. It should be noted that the eggs were collected separately for each female induced.

2.7 Fertilization and Incubation

The milt collected were divided into two parts for each female eggs collected. Fertilization took place by adding milt to the eggs and mixed thoroughly by stirring with plastic spoon. Water was then added to complete the process and excess milt plus water were drained out and the fertilized eggs were evenly spread on the incubating net of mesh size of 1mm (Kakaban). The temperature monitored remains at 27^oC.

2.8 Percentage Hatchability

The number of hatchlings was estimated using volumetric method described by Abdul *et al*. (2017). A sample of 1 liter of water was collected and the number of hatchlings was estimated from the sample. The number of fertilized eggs was determined by multiply the weight of the fertilized eggs in grams by 700 (1 g = 700 eggs) (Viveen*et al*., 1985).

Percentage hatchability = $\frac{number\ of\ hatched\ eggs\quad number\ of\ hatched\ eggs}{number\ of\ fertilized\ eggsnumber\ of\ fertilized\ eggs}$×100(Viveen*et al*., 1985).

2.9 Survival Rate

The survival rate (SR) was determined by finding the percentage of fish fry that remained alive at the end of the experiment from the number of hatched fish

SR = $\frac{No.of\ surviving\ fry}{Total\ number\ of\ hatched\ egg} \times 100 \frac{No.of\ surviving\ fry}{Total\ number\ of\ hatched\ egg} \times 100$ (Olaniyi and Akinbola, 2013)

2.10 Water Quality Monitoring

Water quality parameters were monitored daily at optimum leveland water changed and replaced three times in a week

pH was monitored using pH meter, dissolved oxygenby dissolved oxygen meter, temperature by thermometer, Ammonia monitored using Hagen test kit

2.11 Feeding of Larvae

After hatching, the larvae (yolk sacs) fed from the yolk until the yolk is entirely absorbed the third day. Gemma wean 0.1mm – 0.3mm was given to the fry for 14 days. Then commercial feed (Sketting) 0.5 – 0.8 mm was introduced.

2.12 Cost Benefit Analysis of Hormonal Treatment

The cost benefit analysis was calculated by finding the cost of the hormone used per gram of eggs.

- Cost of Ovaprim: cost of hormone (ml) used injection
- Cost of pituitary: cost of donor broodstock

Cost per gram of egg = $\frac{cosst\ of\ hormone\ (₦)\ cosst\ of\ hormone\ (₦)}{Total\ egg\ stripped\ (g)Total\ egg\ stripped\ (g)}$ (Okere *et al*., 2015)

2.13 Statistical Analysis

The data obtained was subjected to analysis of variance (ANOVA) and students T-test at 5% probability level using SPSS statistical package version 20 software for windows.

3.0 RESULTS AND DISCUSSION

3.1 Physico-chemical Parameters

Mean temperature of the experiment tank of the fish induced with ovaprim was 26.43±0.08^{o} C, while that of tank induced with pituitary was 26.37±0.06^{o} C. The mean pH and dissolved oxygen in the tank induced with ovaprim were 6.57±0.02 and 5.04±0.02 mg/L, respectively, while that of pituitary were 6.45±0.02 and 5.83±0.03 respectively for mean pH and dissolved oxygen.

The mean value ammonia was 0.01±0.2 and 0.06±0.02 for the tank induced with ovaprim and with pituitary respectively.

There was no significant difference ($p<0.05$) in the temperature and Dissolved oxygen of the ovaprim and pituitary treatment tanks. However there was significant different ($p>0.05$) in the pH and ammonia of the two treatment tanks. The result is shown in table 1

Table 1: Mean values of physico-chemical parameter of water

	Treatment tanks	
Water quality	Ovaprim	Pituitary
Temperature (^oC)	26.43 ± 0.08^a	26.37 ± 0.06^a
Ph	6.57 ± 0.02^a	6.45 ± 0.02^b
Dissolved oxygen DO (mg/L)	5.04 ± 0.02^a	5.03 ± 0.02^a
Ammonia (Unionized) (mg/L)	0.01 ± 0.20^a	0.06 ± 0.02^b

$^{a-b}$ Values with the same superscript along the row are not significantly different ($p<0.05$)

The result of this study showed significant difference ($p>0.05$) in the mean pH and Ammonia of the tanks of both treatments. But there was no significant difference ($p<0.05$) in the other water quality parameters as they were kept in optimum level within the limit required for survival of catfish (Ayanwale*et al*., 2014). The water quality parameters observed in this study was similar to the water quality parameters reported by Abdul *et al*. (2017).

3.2 Latency period, Hatchability and Percentage survival

A total number of 19530 eggs were stripped and collected from female fish induced with ovaprim while 20440 eggs obtained from female induced with pituitary.

The latency period of female fish induced with ovaprim was 10.56 hour, while with pituitary was 12.09 hour. There was significant difference ($p<0.05$) in latency period between the two treatments.

The percentage hatchability was higher (65.80±0.81%) for the fish treated with ovaprim than fish treated with pituitary (57.72±0.70%). There was significant different ($p<0.05$) in % hatchability between the two treatments.

Percentage survival rate showed that the treatment with ovaprim recorded 64.83% survival rate while that with pituitary was 58%. There was significant different ($p<0.05$) among the treatment. The result for latency period, hatchability and survival rate is shown in Table 2.

Table 2: Latency period, number of hatched eggs, Hatchability and survival rate of fish induced with ovaprim and pituitary hormone

	Treatment tanks	
Parameters	Ovaprim	Pituitary
Latency period (min)	656.67±30.55[b]	729.67±17.67[a]
Number of hatched eggs	12896±94.06[a]	11792.33±148.88[b]
Hatchability (%)	65.80±0.81[a]	57.72±0.70[b]
Survival (%)	64.83±0.76[a]	58.00±1.0[b]

[a,b] Value with same letter superscript are not significantly different ($p<0.05$)

The latency period for the treatment with pituitary was higher than treatment with ovaprim in this study. This agreed with the report of Abdul *et al*. (2017) who also reported higher latency period with pituitary extract treatment than ovaprim. This difference in the latency period is attributed to variable potency of different hormonal materials, response of different species of fish and temperature as maintained by Bruzuska (2000).

The percentage hatchability of female induced with ovaprim was also higher than that of pituitary in this study. This result is similar to the result of Olaniyi and Akinbola (2003) and Abdul *et al*. (2017) who equally reported higher percentage hatchability in fish induced with ovaprim than those induced with pituitary extract.

However, Okere*et al*. (2015) had contrary report, who recorded higher percentage hatchability in fish induced with pituitary than with ovaprim. Fry survival rate recorded in this study was higher with the fish induced with ovaprim than that of pituitary. This result agreed with the work of Olaniyi and Akinola (2013) and Okere*et al*. (2015) who reported that types of hormonal agent determines fry survival rate apart from such as feed availability, pH, temperature, dissolved oxygen, ammonia nitrite and nitrate etc. as reported by emphasized byAjah (2007).

However, Abdul *et al*. (2017) disagreed with this result as they recorded higher survival rate for fry from female fish induced with pituitary than those from female induced with ovaprim.

3.3 Cost Benefit Analysis of Hormonal Treatment

The comparative cost benefit of hormonal treatment of ovaprim and pituitary is shown in Table 3. Eight hundred and seventy Naira only (#870) was used to purchase 0.37 ml dose administer to the fish (ovaprim = #10000/ 1o ml bottle).

One thousand five hundred and four Naira only (#1504) was used to purchase a male fish whose pituitary was extracted. The cost of the egg stripped from ovaprim induced female was Thirty-one Naira one hundred and eighty-three kobo (#31.183), while that stripped from pituitary treatment was fifty one naira five hundred and seven kobo only (#51.507).

The result of comparative cost benefit of ovaprim and pituitary is higher with ovaprim than pituitary. This agreed with the report of Adebayo and Popoola (2008); Olaniyi and AKinbola (2013) and Okere*et al*. (2015). From the result, the comparative cost benefit of gram of egg produced is higher with pituitary than ovaprim which also agreed with the report of Okere*et al*. (2015). However, this report was contrary to the report of Abdul *et al*. (2017) who comparative cost benefit for egg production higher in ovaprim induced fish than pituitary induced fish and this could be why they had high percentage survival rate.

Table 3: Comparative cost benefit of ovaprim and pituitary extract administered to the fish

Parameters	Dosage (ml)	Egg weight (g)	Cost (#)
	0.37	-	870
Ovaprim	-	27.9	870
	-	27.9 g	31.183
	0.75	-	1,504
Pituitary	-	29.2	1,504
	-	1	51.507

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

This study revealed the used of synthetic hormone (ovaprim) and non-synthetic hormone (*Clariasgariepinus*pituitary hormone) in artificial breeding of African catfish (*Clariasgariepinus*). This comparative study showed a reflection of the superiority of ovaprim over pituitary in latency period, percent fry survival rate, hatchability and cost benefit of the hormone.

4.2 Recommendations

It is therefore recommended that ovaprim should be used as an inducing hormone for *Clariasgariepinus* in artificial breeding because of the benefit stated above and also convenience in preparation. However, further study should be carried out on other synthetic hormone and other species of fish.

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