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A REVIEW ON EFFICACY OF TWO SYNTHETIC HORMONES (OVAPRIM AND OVATIDE) ON INDUCED SPAWNING OF AFRICAN CATFISH (*Clarias gariepinus)*:

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ABSTRACT
The comparative study on the efficacy of two synthetic hormones ovaprim and ovatide was review based on the published information with the aim of evaluating the best induced spawning hormone to be used to in Clarias gariepius. Induced spawning of C. gariepinus with ovaprim and ovatide synthetic hormones by various researchers were examined and evaluated on the basis of milt volume, fecundity, percentage fertilization, hatchability, stripped eggs and survival rate. From the results obtained, ovaprim performed better than ovatide, but ovatide has the highest performance in terms of milt volume. Though, the researchers employed different methods in obtaining their results, even at that their studies revealed the effectiveness of ovaprim over ovatide. There is a significant different (P<0.05) in C. gariepinus induced with ovaprim synthetic hormone compared to ovatide synthetic hormone. The use of synthetic hormones in induced fish spawning generally improves the production of C. gariepinus to meet the required demand for fish seed. This review revealed that ovaprim performed better followed by ovatide.

Key Words: Induce spawning, Clarias gariepinus, Ovaprim, Ovatide and reproductive performance.

INTRODUCTION
The farming of aquatic life in an enclosure, including fish, crustaceans, mollusks, and aquatic plants, is known as aquaculture. Due to the growing need for fish as a primary source of protein worldwide during the past few decades, aquaculture has grown and diversified (Gabriel and Akinrotimi, 2011). According to certain studies (Ali *et al*., 2014; Sharker *et al*., 2020; Kubra *et al*., 2020), aquaculture is expanding in Nigeria in an effort to meet the country's expanding need for edible fish. As a result, these activities are acknowledged. Due to the rising need for a cheap, delicious, and healthful source of fish protein to feed the burgeoning population, it is currently one of the agricultural subsectors with the quickest rate of growth (Mann 2011). It has a significant impact on national income, the creation of jobs, socioeconomic growth, and food security. According to FAO (1996), aquaculture practices around the world are heavily dependent on the availability of inputs, particularly high-quality fish seeds, which are essential to the smooth operation of the farm and the ability to meet the ever-increasing demands of the fish market. This is because fish produced by natural propagation are very low in number and cannot satisfy the demands of their consumers for protein. Most fish farmers do not know how to produce their own fingerlings; they tend to procure fish seed from a distance of which cost of production and transportation is high. This often leads to low production as well as scarcity of quality fingerlings which has been one of the major constraints for the expansion of catfish culturing in Nigeria. The breeding of the fish by using spawning agents to stimulate ovulation is the most promising and reliable way of ensuring availability of good quality fish seed for all year round and sustainability of the fishery products (Brzuska 2003). Various synthetic and natural hormones have been used to induce breeding successfully (Zohar and Mylonas, 2001). Some of these spawning agents are either difficult to quantify, ineffective, have a short shelf life or expensive as reported by (Olubiyi *et al.,* 2005). According to Nwokoye *et al.* (2007), ovaprim is the most widely acceptable and readily available hormone used as spawning aid to induce ovulation in well-conditioned brood fish because it has been found to be very effective. The

manufacturer's recommended dosage is 0.5ml per kilogram body weight of the fish. Similarly, Ovatide is another hormone used as spawning aid to induce ovulation in fish and its manufacturer's recommended dosage is 0.2 ml per kilogram body weight of fish (Sahoo *et al.,* 2005

Artificial breeding otherwise known as hypophysation refers to a process in which some hormones or stimulants are injected into the brood fishes, which do not breed in the closed water bodies as a causing the fishes to breed (Munsur *et al.,* 2016). Artificial breeding is practiced with the involvement of reproductive hormones. Induced breeding through hormone treatment and artificial incubation of fertilized eggs has advantages of better rate of fertilization and hatching, better conditions for growth and survival of larvae to fingerlings and better protection of larvae against unfavorable environmental condition and predators (Woynarovich and Horvath, 1980).

Artificial propagation of African catfish *(C. gariepinus*) is the most promising and reliable way of ensuring large scale production of quality fish seeds throughout the year and sustainability of the aquaculture sector (Van Oordi, 1987). Artificial reproduction and selective breeding has become very popular nowadays in the age of science and technology as a means of ensuring large scale production of fish seeds throughout the year. Artificial propagation methods constitute the major practicable means of providing enough quality seed for rearing in confined fish enclosure such as fish ponds, reservoirs and lake (Charo and Oirere, 2000). It is clearly disadvantageous to cultivate any organism when the supply of the young cannot be easily replenished. Among numerous species of fish under cultivation in Nigeria, notable are: common carp *(Cyprinus carpio*), Catfish (*Clarias gariepinus*; *Heterobranchus* Specie Grey mullet (*Mugil cephalus*) and Tilapia Specie (Olubiyi *et al.,* 2005)

Synthetic hormones are chemical messengers that are responsible for the communication between different types of cells that recognize their identity and function through receptors, which are protein structures specialized in molecular recognition. Synthetic hormones in aquaculture are used for artificial reproduction and sex reversal. The first sustains the production chain with the constant production of seeds. The second is used when the growth rate and/or gain weight are different between the male and female. This difference between genders is very common in teleost fish and usually occurs during puberty (Taranger *et al.,* 2010). Nevertheless, the use of hormonal products in fish farming can have harmful consequences, such as potential risks to human and environmental health related to hormone-dependent parameters. Moreover, its use outside of good animal husbandry practices may affect not only the fish farming production system itself but also the commercialization of this food commodity. In fisheries, stimulation of ovulation by synthetic means is gaining popularity because successful ovulation corresponds to maximum fish production and economic benefits if other conditions required for fish rising are strictly maintained.

In order to boost fish production on a level that will be able to serve people as reliable source of protein, there is a need to be able to reproduce fish on a large basis in and out of season to ensure regular supply. Artificial reproduction and selective breeding has become very popular nowadays in the age of science and technology as a means of ensuring large scale production of fish seeds throughout the year. Artificial propagation methods constitute the major practicable means of providing enough quality seed for rearing in confined fish enclosure such as fish ponds, reservoirs and lake (Charo and Oirere, 2000).

The African catfish, *Clarias gariepinus*, also called with local (Hausa) Tarwada is the favorite fish for aquaculture in West Africa, Asian and other parties of the African continent (Adewumi and Olaleye, 2011). The species is dominant in freshwater environments including lakes, rivers and dams. *C. gariepinus* has been preferably in aquaculture due to its ease of culturing, fast growth rate, high resistance to disease, and tolerance of a wide range of temperature, low dissolved oxygen as well as high salinity levels, high stocking culture conditions, good quality meat and most importantly high commercial value (Haylor, 1991; Goos and Richter, 1996; Muchlisin *et al.,* 2010; Oyeleye *et al.,* 2016; Shourbela *et al.,* 2019;)

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 fish; 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 (Olaniyi and Akinbola, 2013).
The objective of this review is to compare the effectiveness of two synthetic hormones; Ovaprim and Ovatide on reproductive performance of *C. gariepnus*

Advantages of Induced Spawning in *Clarias gariepinus*
(i) A pure spawn of a desired species is made available. The spawn obtained from the rivers are not pure. They are mixed with the spawns of other species and sorting of pure seed from the mixed spawn is not possible.
(ii) Desired species of *C. gariepinus* can be cultured through the induced breeding.
(iii) Large numbers of eggs are available from a fish through induced breeding.
(iv) In a single season, *C. gariepinus* can be induced to breed more than once.
(v) Transportation cost becomes very low as the *C. gariepinus* can be breed in any desired pond.
(vi) Between the different species of fishes hybridization can be done and it is possible to get

Comparative Studies on Synthetic Hormones
Effects of Ovatide and Ovaprim on the Milt Quality and Reproductive Performance of Male Milt Quality and Reproductive Performance of Male *C. gariepinus*
The research on the effects of two synthetic hormones (Ovatide and Ovaprim induced milt on fertilization, hatchability, survival and the control groups on female (*C. gariepinus*) eggs was conducted by Ogunluase and Adebaye (2014) and the result is presented in Table 1. The Table shows the effects of the milt collected from the hormonally induced groups and the control group of female *C. gariepinus.*
The result obtained from their research on female *C. gariepinus* eggs showed that, the milt of male induced with the synthetic hormones (Ovatide and Ovaprim) on fertilization, hatchability, survival had higher percentage fertilization, hatchability and survival which were significantly different from the control group. Even though the two synthetic hormones used in this study performed better but when comparing the two hormones, Ovaprim has the highest percentage fertilization (94.40 ± 2.03^{b}), highest percentage hatchability (66.37 ± 0.74^{c}) and highest percentage survival (77.38 ± 5.95^{a}) respectively, while Ovatide recorded the lowest percentage fertilization (87.73 ± 3.38^{b}), lowest percentage hatchability (59.70 ± 0.88^{b}) and lowest percentage survival (63.56 ± 13.56^{a}). The hatching period was the same for all the treatment, while the hatching time varied with the highest time observed from the control.

Table 1: Reproductive performance of induced male milt on fertility, hatchability and survival percentage of *C. gariepinus* eggs.

Parameter	Control	Ovatide	Ovaprim
Fertilization (%)	63.81 ± 5.21^{a}	87.73 ± 3.38^{b}	94.40 ± 2.03^{b}
Hatchability (%)	14.14 ± 2.14^{a}	59.70 ± 0.88^{b}	66.37 ± 0.74^{c}
Survival (%)	61.91 ± 4.77^{a}	63.56 ± 13.56^{a}	77.38 ± 5.95^{a}
Hatching time	26.5 ± 0.50^{a}	23.5 ± 0.50^{a}	24 ± 00^{a}
Hatching period	72 ± 00^{a}	72 ± 00^{a}	72 ± 00^{a}

Mean values in the same row having the same superscript are not significantly different (Ogunluase and Adebaye, 2014).

Effect of Ovatide and Ovaprim on Motility Duration, Percentage and milt Volume.

A review was also done on the research carried by (Oguntuase and Adebayo, 2014) on the effect of Ovatide and Ovaprim milt motility duration, motility percentage and milt volume is presented as seen on table 2.

The study shows that Ovprim was higher (29.58s) in terms of motility duration while Ovatide was lower (26,25s) in motility duration of the milt. Ovaprim was reported to be the highest (85.75%) motility percentage while the Ovatide has the lowest (78.90%) percentage motility. But Ovatide has the highest (1.16ml) milt volume while Ovaprin has the lowest (0.6ml) of milt volume.

Parameters	Control	Ovatide	Ovaprim
Motility duration	17.87s	26,25s	29.98s
Motility (%)	61.54	78.90	85.75
Milt volume (%)	o.23ml	1.16ml	0.6ml

Mean values in the same row having the same superscript are not significantly different (Ogunluase and Adebaye, 2014)

Effect of Ovaprim and Ovatide on the Induced Spawning of *C. gariepinus*

A study on the effects of Ovaprim and Ovatide on the spawning indices of *C. gariepinus* in relation to latency period was carried out by Abubakar (2016) and the result is presented in table 3. The study was conducted on *C. gariepinus* where he administered both Ovaprim and Ovatide at 0.5ml/kg per body weight at three different latency periods (8hrs, 10hrs and 12hrs). It was found out in his study that the highest number of stripped eggs (53.26 ± 0.2^{a}), highest mean percentage fertilization (83.57 ± 1.13^{a}) and the highest mean percentage hatchability (92.82 ± 1.62^{a}) was at 12hrs latency period in Ovaprim, while the lowest (8.53 ± 0.82^{c}) number of stripped eggs, lowest mean percentage fertilization (44.44 ± 1.90^{c}) and the lowest mean percentage hatchability (64.06 ± 1.82^{c}) was at 8hrs latency period in Ovatide. Latency period has a significant effect on the number of stripped eggs, percentage fertilization and percentage hatchability. All the parameters examined using Ovaprim had higher values over Ovatide.

Table 3: Effect of Ovaprim and Ovatide on the Spawning Indices of *C. gariepinus*

Latency period (Hours)		Number of stripped eggs	Number of fertilized eggs	Number of hatched eggs	Percentage fertilization (%)	Percentage hatchability (%)	Survival rate (%)
8	**1**	$10.150+0.3^{c}$	$5,624+0.4^{c}$	$2,354+04^{c}$	$55.41+013^{c}$	$41.86+0.24^{c}$	$42.3+1.41^{c}$
	2	$8.53+0.82^{c}$	$3.45+0.03^{c}$	$2.210+0.42^{c}$	$44.44+1.90^{c}$	$64.06+1.82^{c}$	$41.2+2.01^{c}$
10	**1**	$30,36+0.5^{b}$	$23,30+0.3^{b}$	$19,224+0.3^{b}$	$76.75+1.21^{b}$	$82.59+0.53^{b}$	$45.2+0.62^{b}$
	2	$21.25+0.4^{b}$	$15.32+0.06^{b}$	$10.230+0.3^{b}$	$72.09+1.93^{b}$	$66.78+1.96^{b}$	$44.2+1.13^{b}$
12	**1**	$53,27+0.2^{a}$	$44,25+0.02^{a}$	$37,360+0.1^{a}$	$83.57+1.13^{a}$	$92.82+1.62^{a}$	$57.1+0.34^{a}$
	2	$50.36+0.32^{a}$	$36.72+0.02^{a}$	$30.13+0.12^{a}$	$72.91+2.24^{a}$	$82.04+1.88^{a}$	$53.2+1.46^{a}$

Mean within the column with the same superscript are not significantly different (P>0.05) (Abubakar 2016)

KEY
1: Ovaprim
2: Ovatide

Assessment of the effects of Ovaprim and Ovatide on the Spawning Performance of Catfish (*C. gariepinus*)

A comparative study on the effects of Ovaprim and Ovatide on the spawning performance of *C. gariepinus* was also conducted by Obaje *et al.,*, (2017) in Benue state, Nigeria. The study was done on *C. gariepinus* where they injected three female fish with ovaprim at three different doses (0.8ml/kg, 0.5m/kg and 0.3ml/kg) with Ovatide also they injected three female fish at three doses

(0.3ml/kg, 0.2l/kg and 0.1m/kg) in order to determined which synthetic hormone and dosage would give the best output in the spawning performance of *C gariepinus*.
The result on the mean weight of male and female, mean egg weight, mean latency and mean incubation period is shown in Table 4 while the fecundity rate, fertilization rate and hatchability rate of *C. gariepinus* of both the synthetic hormones is shown in table 5
It was revealed in their study that the highest weight of stripped eggs was (185.50g) found in fish injected with 0.8ml/kg Ovaprim. The lowest weight of stripped egg obtained was (162.70g) in Ovatide injected with 0.3ml/kg. The latency period was between 8-10 hours and the incubation period was between 20-24 hours for the both synthetic hormones used.

Table 4: The Fish Weight, Mean Egg Weight, Mean Incubation and Latency Period during Spawning of *C. gariepinus*

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±0.029a	1.2±0.101a	185.20±0.20a	8.16±10.00a	20.66±40.00a
0.5	1.0±0.031a	1.5±0.203b	166.25±0.25b	11.66±20.00b	23.00±25.00b
0.3	1.0±0.029a	1.2±0.122a	178.30±0.26a	10.00±12.00b	22.66±27.00b
P value	p>0.05	P<0.05	P<0.05	P<0.05	P<0.05
Ovatide					
0.3	1.2±0.019a	1.3±0.100a	162.70±0.24a	8.33±12.500a	20.83±30.00a
0.2	1.0±0.031a	1.5±0.201b	175.60±0.23b	11.50±15.00b	22.83±32.00b
0.1	1.1±0.029a	1.2±0.022a	178.20±0.26b	10.00±11.00b	22.50±38.00b
P value	p>0.05	P<0.05	P<0.05	P<0.05	P<0.05

(**Obaje *et al.*, 2017)**

Fecundity Rate of Ovaprim and Ovatide
The highest fecundity rate of (92,600 eggs) was observed in the fish injected with 0.8ml/kg of ovaprim and the lowest fecundity of (83,125 eggs) was observed in the fish that was injected with 0.2ml/kg of Ovatide. The results showed that there was a significant difference (p<0.05) between the two synthetic hormones used.

Fertilization Rate of Ovaprim and Ovatide
The result reviewed on the effect of ovaprim and Ovatide on the spawning performance of *C. gariepinus* revealed that the highest fertilization rate (84.47%) was observed in the fish that was injected with 0.8ml/kg of ovaprim while the lowest fertilization rate (50.05%) was recorded in the fish that was injected with 0.2ml/kg of Ovatide. The results showed that there was a significant difference (P<0.05) between Ovaprim and Ovatide synthetic hormones used.

Hatching Rate on Ovaprim and Ovatide
As reviewed the hatching rate was observed to be highest (62.46%) in the fish that was injected with 0.8ml/kg of ovaprim. In Ovatide synthetic hormones the lowest hatching rate of (47.93%) as recorded in the fish that was injected with 0.2ml/kg. The results showed a significant difference (p<0.05) between the hormones used.

Table 4: Effects of Ovaprim and Ovatide on Fecundity Rate, Fertilization Rate and Hatchability Rate.

Hormones Doses (ml/kg)	Fecundity Rate (eggs)	Fertilization Rate (%)	Hatchability Rate (%)
OVAPRIM			
0.8	92,600 [a]	84.47 [a]	62.46 [a]
0.5	83.125[c]	79.30[b]	62.04[b]
0.3	89,150[b]	76.43[c]	54.01[c]
OVATIDE			
0.3	86,200[b]	78.62[b]	55.57[b]
0.2	81,250[c]	50.05[c]	47.93[c]
0.1	89,100 [a]	81.82 [a]	70.21 [a]

(Obaje *et al.,* 2017)

CONCLUSION

The use of synthetic hormones in induced fish spawning generally improve the production of *C. gariepinus* to meet the required demand for fish and fish seed for fish farming. From the review, synthetic hormones ovaprim and Ovatide could be used for induced spawning of *C. gariepinus*. Also, the success of artificial propagation of *C. gariepinus* through induced breeding under controlled environmental condition is mostly depending on latency period and temperature. For all studies reviewed, ovaprim performs better than Ovatide.

The use of synthetic hormone is a better way of improving catfish production with respect to reproductive performance in aquaculture. Stimulation of males by synthetic hormones significantly increased volume of milt, motility duration and percentage. The efficacy of these synthetic hormones was evident on the reproductive performance as tested on the female *C. gariepinus*. The study has shown that, artificial stimulation of male *C. gariepinus* using synthetic hormone is more reliable in reproducing fish. The use of these hormones in male fish is a means of boosting reproductive performance and ensuring good and viable fish seeds. The results arising from this trial is important in encouraging fish seed production through the use of synthetic hormones. This also proved that Ovaprim is the best.

In the induction of *Clarias gariepinus*, the use of ovaprim at 0.8ml/kg and Ovatide at 0.1ml/kg doses are recommended for fish farmers or breeders for inducing spawning. Finally, this review revealed that Ovaprim performed better followed by Ovatide. The authors suggested the farmers to go for Ovaprim instead of Ovatide though Ovaprim is more expensive based on the current market price but the interest that will be realized from the sales can cover the cost incurred.

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