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EFFECT OF CARP PITUITARY EXTRACT AND OVAPRIM HORMONE ON REPRODUCTIVE PERFORMANCES OF AFRICAN CATFISH (*CLARIAS GARIEPINUS*)

Ahmed A. A. Ali[1], Mohamed E. Farag[2] and Adel Fathey[3]

[1,3] *Fish physiology and hatchery Department.*

[2] *Genetics Department.*

Central Laboratory for Aquaculture Research, Abbassa, Sharkia, Egypt.

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ABSTRACT

The present study was conducted to evaluate the effect of carp pituitary extract (CPE) and Ovaprim hormone on reproductive performance of broodfish African catfish (*Clarias gariepinus*). A total number of fish were 45 males (796-803.3 g) and 45 females (781-782.3 g). All fish were divided to three treatments. First treatment 15 females injected with carp pituitary extract 4 mg / kg (CPE) and 15 males were injected with carp pituitary extract 2 mg / kg (CPE) in three tanks . Second treatment 15 females injected with 1 ml Ovaprim /kg and 15 males injected with 0.5 ml Ovaprim /kg in three tanks. The third treatment 15 females were injected with 0.5 ml Ovaprim /kg and 15 males injected with 0.25 ml Ovaprim /kg each treatment in three tanks. The results of the latency time, total eggs number, mass of eggs/Female, total Fry number, fry number/ Female, hatching rate, relative fecundity, total amount of dose, total cost of dose and the cost of dose/ 1000 fry were recorded. The results revealed that total eggs number, mass of eggs/Female, total Fry number, fry number/ Female, hatching rate and relative fecundity were significantly higher in hormonal injected than in CPE treatment. While, Ovaprim used at 0.5 ml/kg/female and 0 .25 ml/kg/male lower the cost of dose/ 1000 fry, LE than injected with CPE.

INTRODUCTION

The African catfish *Clarias gariepinus* is widely distributed throughout Africa and has long been considered as one of the most suitable species for culture (Costaz *et al*., 1990). This species is known for its high growth rate, resistance to handling and stress, relatively low requirements for water quality amenability to high stocking densities excellent meat quality and preference amongst consumers in many African countries. Although, *C. gariepinus* is

widely cultured in South Africa and increasingly in Nigeria, it has not emerged as an important aquaculture species in many other countries because of in adequate supply of fingerlings. This fish has attracted interest as a potential species for fish culture in Upper Egypt and other countries and may be propagated in natural conditions in small ponds, in semi-natural conditions using hypophysation and artificial nests installed in spawning grounds (De Graaf and Janssen, 1996) or under controlled conditions. Owing to the economic value of this species, the latter method of catfish reproduction has became increasing popular in several different European countries since the mid – 1970s. Several authors have used hypophysation for inducing ovulation in African catfish females (El-Naggar *et al.,* 2006*).* This obstacle still exists despite the fact that protocols for controlled spawning and indoor rearing of *C. gariepinus* larvae have been established *(*Gheyas *et al.,* 2001*).* The fish can be cultured under different water conditions, live in brackish waters, excellent fish for culture in small water areas, large size, fast growth, omnivorous and resistance to extreme environmental conditions *(*Akar, 2008*).* The fish has relatively simple techniques for their artificial reproduction *(*Akar and Ali, 2006*).* The main species cultured are *Clarias batrachus* in Thailand, Indonesia and India, *C. fuccus* in Philippines and *Clarias gariepinus* in African *(*Brzuska *et al.,* 1999*).*

The problem associated with wild fish seed such as seasonality in availability, uncertainty of species of fish seed collected, disease infestation and limited quality of harvestable fish seed (Olumuji, 2012) wild sources are unreliable and hence the need for seeds production using hormones. The hormones promote reproduction in fish which is controlled by several factors such as sex steroids in the regulation of reproductive processes (Kime, 1993). These reproductive processes are controlled through the brain-pituitary gonadal axis. The brain is stimulated by environmental factors (water rise, temperature, feeding, rainfall, and photoperiod) to release gonadotropin releasing hormones (Zhuo *et al.,* 2011). The ovulation and spermiation are affected as a result of the sex steroids that have been produced (Żarski *et al.,* 2015) Administration of

these hormones to induce ovulation and spawning in fish is achieved through artificial propagation with either natural or synthetic hormones (Ngueku, 2015).

The present study was designed to comparison between carp pituitary extract (CPE) and Ovaprim hormone on reproductive performance of broodfish African catfish (*Clarias gariepinus*).

MATERIALS AND METHODS

The present study was conducted at Abbassa Fish hatchery, Central Laboratory for Aquaculture Research, Abbassa. A total number of 90 apparently healthy *Clarias gariepinus* broodstock 45 males and 45 females. A total number of fish were 45 males (796-803.3 g) and 45 females (781-782.3 g) were separated by two sexes in earthen ponds starting about mid March and given a 25% protein feed at 3 % of total body weight every day except Friday. In May, when climatic conditions were suitable for spawning and average daily water temperature was 26-28^{o}C, females were examined and their readiness to spawn assessed on the basis of external features and release of eggs upon gentle pressure on the abdomen and acclimatization for 24 hrs, the water quality was measured (Dewis and Freiles, 1970) (Table1).The fish transported to circular fiberglass tanks with capacity of 5000 liters. Fish were distributed randomly in ninth fiberglass tanks in 5 meter capacity each at a rate of 5 females and 5 males/ tank. This tank was supplied with water aerated. These tanks were divided into three treatments. The first treatment, females were injected with carp pituitary extract 4 mg/kg (CPE) and males were injected with carp pituitary extract 2 mg/kg. Second treatment females injected with 1 ml Ovaprim/kg and males injected with 0.5 ml Ovaprim /kg. The third treatment females injected with 0.5 ml Ovaprim /kg and males injected with 0.25 ml Ovaprim /kg. Water levels were maintained at 30 cm, female left for spawning in tank and collect eggs in basket of plastic mash and it was incubated in fiberglass which supplied with continuous water source at temperature of 26-28 ^{o}C (Brzuska *et al*., 1999).

Table1. Physico-chemical characteristics of water used during experiment.

Items	Mean	Items	Mean
Temperature(c)	26-28 °C	**Nitrate (mg/l)**	0.01
PH	8.7	**Nitrite (mg/l)**	0.02
Oxygen (mg/l)	8.1	**Salinity (mg/l)**	0.3

Salinity was calculated by relation (1000 micromos =0.7g salinity according to Dewis and Freila, 1970.

Latency time: (time between the primary injection and ovulation)

The measurement taken during the experiment, the percentage of fertilization was estimated after 6 hrs of eggs incubation *(*Kouril *et al.*, 2003) as follows:

Hatching rate = (Number of hatched eggs (larvae) /Total number of eggs) ×100

Then after 24 hrs of eggs incubation hatching percentage was estimated.

Relative fecundity = (Eggs Number/Female)/weight of female (g).

The relative fecundity is the total number of ripe eggs per grams of female body weight (Bagenal, 1978).

Statistical analyses.

Statistical analyses were carried out using statistical analysis systems (Mis, 1977). Data were analyzed using SPSS methods and one way analysis of variance ANOVA was used to determine significant differences of the main effects and Duncan- multiple-range test were performed to determine significant differences.

RESULTS AND DISCUSSION

Table 2 shown the results of using carp pituitary extract (CPE) and Ovaprim hormone to improve the reproduction of African catfish (*Clarias gariepinus*). The result showed that the percentage of responding after latency time (time between the primary injection and ovulation) was 18 hrs in group injected CPE while, in females injected with 1 ml Ovaprim /kg and females injected with 0.5 ml Ovaprim /kg were 16 hrs and 16.5 hrs respectively. The

results of total eggs number/tank was improved by using ovaprim hormone and the best values found with 1 ml/kg followed by 0.5 ml/kg than using pituitary extract where the values was (249320, 179863 and 139165) respectively, eggs number/Female, total Mass of eggs (g) and mass of eggs/Female (g) were taken the same trends and significantly higher in females injected with 1 ml Ovaprim /kg and females injected with 0.5 ml Ovaprim /kg than females were injected with 4 mg / kg (CPE) carp pituitary extract where the values was (49864, 35973 and 27833) for egg No/female, (560, 415 and 321) for total mass of egg and (112, 83 and 64.2) for mass of egg/female (Table 2). These results are consistent with previous review of **(**Mosha, 2018) who suggests that African catfish seeds production can be encouraged through the use of Ovaprim hormone. Also (Schulz and Goos, 1999) reported that the increase of ovulation rate of *Clarias gariepinus* may be accelerated Oogenesis that could be controlled by stimulating hormone (FSH) and Luteinizing hormone (LH) and need also participation of several paracrine and autocrine mechanisms regulation.

Table 2. Effect of carp pituitary extract and ovaprim hormone on reproductive performances of Cat fish (*Clarias garbinius*).

Items	CPE Treatment	Ovaprim Treatment		F value	ig.
	4mg / kg (Mean ± SD)	1ml / kg (Mean ± SD)	0.5 mg / kg (Mean ± SD)		
Latency time (hours)	18.0 ± 1	16.0 ± 1	16.5 ± 1	3.3	s
Female body weight (g)	781.0 ± 14.93	781.7 ± 15.28	782.3 ± 12.50	0.007	s
Male body weight (g)	796.0 ± 5.29	803.3 ± 15.28	801.7 ± 7.64	0.416	s
Total eggs number/ Tank	139165 ± 1778 ^{c}	249320 ±4775^{a}	179863±2894.^{b}	813.1	**
Eggs number/ Female	27833 ± 223^{c}	49864 ± 955^{a}	35973 ± 578^{b}	884.7	**
Total Mass of eggs (g) / Tank	321 ± 6.55^{c}	560 ± 17.32^{a}	415 ± 5^{b}	354.5	**
Mass of eggs/Female (g)	64.2± 0.577^{c}	112.0 ± 3.46^{a}	83.0 ± 1^{b}	399.5	**

Mean having different small letters are significantly different ($p \leq 0.05$).

Table 3. Effect of carp pituitary extract and ovaprim hormone on fry and economic values of Cat fish (*Clarias garbinius*).

Items	CPE Treatment	Ovaprim Treatment		F value	ig.
	4mg / kg (Mean ± SD)	1ml / kg (Mean ± SD)	0.5 mg / kg (Mean ± SD)		
Total Fry number/ Tank	16162 ± 691^{c}	159468 ± 2960^{a}	88393 ± 1470^{b}	4053.2	**
Fry number/ Female	3232 ± 138^{c}	31893 ± 592^{a}	17678 ± 294^{b}	4053.2	**
Hatching rate (%)	11.6 ± 0.35^{c}	64.0 ± 0.04^{a}	49.1 ± 0.04^{b}	34541	**`
Relative Fecundity	35.6 ± 0.26^{c}	63.8 ± 0.24^{a}	46.0 ± 0.07^{b}	14323.4	**
Total amount of dose / Tank	23.58 ± 0.32^{a}	5.91± 0.10^{b}	2.96± 0.02^{c}	9398.7	**
Total cost of dose (LE) / Tank	157.2 ± 2.20^{c}	591.7± 10.1^{a}	295.2 ± 2.43^{b}	3928.1	**
The cost of dose /1000 fry, LE	0.0097 ± 0.0003^{a}	0.0037± 0.00003^{b}	0.0033± 0.00003^{c}	1202	**

Mean having different small letters are significantly different ($p \leq 0.05$).
Hatching rate = (Number of hatched eggs (larvae) /Total number of eggs) ×100
Relative fecundity = (Eggs Number/Female) /weight of female (g) .

Spawning is the outcome of a complex interplay of physiological and environmental factors. The role of an endogenous rhythm determined by environmental factors in causing cyclical changes in ovarian activity (Teugels, 1984) while, the convergence of biotic and a biotic environmental cues on hypophysiotropic, neuroendocrine systems in both the brain and the pituitary gland can induce changes in the activity of the brain-pituitary gonad axis (Thanae, 1994). Where Viveiros *et al.*, 2002 reported that a gonadotropin surge has been observed in spermatization and spawning. The result in Table 3 shown that total fry number, fry number/Female, hatching rate and relative fecundity were significantly higher in females injected with 1 ml Ovaprim /kg and females injected with 0.5 ml Ovaprim /kg than females were injected with 4 mg / kg (CPE) carp pituitary extract where the values was (159468, 88393 and 16162) for total fry No/tank, (31893, 17678 and 3232) for fry No/female, (64, 49.1 and 11.6) for hatching rate and (63.8, 46 and 35.6) for relative

fecundity respectively. While, Total amount of dose and the cost of dose/ 1000 fry, LE were significantly higher in injected CPE than injected Ovaprim hormone and lower cost injection in injected CPE 314 LE than injected Ovaprim hormone (1 ml and 0.5 ml) were 1183.3 and 591.5 LE respectively. The same result agree with Nwokoye (2007) reported that Ovaprim (0.4-0.5 ml/kg) has been known to have better results because of its potency and quality as well as its relatively cheaper cost, ease handling and better survival of hatchlings. In addition, the price of Ovaprim increases indiscriminately due to import duties. Therefore, to reduce the cost of production arising from purpose of Ovaprim, there is needed to find an alternative cheaper spawning aid (Olaniyi and Akinbola, 2013).

CONCLUSION

Generally, induce breeding in African catfish (*C. gariepinus*) by using Ovaprim hormone at 0.5 ml/kg was availability of matured quality eggs and high number of larvae for commercial fish farming. In addition, higher fertilization and hatching rate were achieved when Ovaprim used at 0.5 ml/kg of fish compared to carp Pituitary Extract (PCE). Therefore, the use of synthetic hormone particularly Ovaprim 0.5 ml/kg ensure for better results in ovulation, spawning of eggs and the cost of dose/ 1000 fry, LE.

REFERENCES

Akar. A.M., 2008. Ovulation induction in African catfish using carp and Catfish pituitary extract and ovaprim. Abbassa.Int. J. Aqua., (1A): 79-92.

Akar, A.M and M.A. Ali, 2006. Artificial spawning of African catfish (*Clarias garipenus*). After stimulation of ovulation with carp pituitary extract, human chorionic gonadotrophin and mixed injection. Egypt.J. of Appl. Sci., 21 (2): 8-16.

Bagenal, T.B., 1978. Methods for assessment of fish production in freshwaters. Oxford: Blackwell Scientific Publications, 365.

Brzuska, E.; R.J.Raczkevi; J. Adamek and F. Radies, 1999. Preliminary Investigation on the ovulation, embryonic survivel and larval

morphology in African catfish (*Clarias gariepinus* Burchell, (1822). In Hungarian with English summary Halaszat, 2: 88-92.

De Graaf, G. and H. Janssen, 1996. Artificial reproduction and pond rearing of the African catfish (*Clarias gariepinus*) in Sub-Saharan Africa. FAO Fisheries Technical Paper 362, 73.

Dewis, J. and T. Freiles, 1970. Physical and chemical methods of soil and water analysis. FAO soils. Bulletin, 10: Rome.

El-Naggar, G.O; J. George; M. Rezk; W. Elwan and M. Yehia, 2006. Effect of var-Ying density and water level on the spawning response of African catfish *Clarias gariepinus*: Implications for seed production. Aquaculture, 261 : 904-907.

Gheyas, A.A; A.F. Mollah; M.S. Islam and M.G. Hussain, 2001. Cold-shock induction of diploid gynogenesis in stinging catfish, Heteropneustes fossilis. Journal of Applied Aquaculture, 11 (4): 227-240.

Kime, D.E., 1993. Classical and non-classical reproductive steroids in fish. Rev. Fish Biol. Fish, 3: 160-180.

Kouril, J; R. Vachta and T. Barth, 2003. Hamonally Induced artificial propagation Of tench (*Tinca tinca*) females by means of combined preparations Containing analogue GnRH and dopaminergic inhibitor: In: Proce-Edings of The 6 th Gzech conference of Ichthyology. Agriculture University of Progue. Czech Republic, (ed By M. svatora). 41-47 (in Czech).

Mosha, S.S., 2018. Recent Comparative Studies on the Performance and Survival Rate of African Catfish (Clarias gariepinus) Larval Produced under Natural and Synthetics Hormones: A Review Mosha, J. Aquac. Res. Development, 9:3.

Mis, J., 1977. Reproduction results of European catfish in experimental station of Polish Academy of Sciences in Golysz. Gospodarka Rybna, 2, 3.(In Polish).

Ngueku, B.B., 2015. The efficacy of synthetic and non-synthetic hormones in the induced spawning of the African Catfish (Clarias gariepinus Burchell, 1822). Int. J. Fish. Aquat. Studies, 3: 34-37.

Nwokoye, C.O. ; L.A. Nwuba; J.E. Eyo, 2007. Induced propagation of African clariid catfsh, Heterobranchus bidorsalis using synthetic and homoplastic hormones. Afr. J. Biotechno., 6: 2687-2693.

Olaniyi, C.O. and D.O. Akinbola, 2013. Comparative studies on the hatchability, performance and survival rate of African catfsh (Clarias gariepinus) larval produced using ovaprim and catfsh pituitary extract hormones. Journal of Biology, Agriculture and Healthcare, 3: 57-62.

Olumuji, O.K. and M.K. Mustapha, 2012. Induced breeding of African Mud catfsh, Clarias gariepinus (Burchell 1822), using different doses of normal saline diluted ovaprim. J. Aquacult. Res. Dev., 3: 133.

Schulz, R.W. and H.J.T. Goos, 1999. Puberty in male fish: concepts and recent developments with special reference to the African catfish (*Clarias gariepinus*). Aquaculture, 177: 5-12.

Teugels, G.G., 1984. The nomenclature of African Clarias species used in aquaculture. Aquaculture, 38: 373-374.

Thanae, M.A.A.S., 1994. Biocemical Study on Heavy Metals Residues in Some Fishes. (Ph. D.) Biochemistry and Clinical Biochemistry Department. Faculty of Veterinary Medicine, Alexandria University.

Viveiros, A.T.M.; Y. Fessehaye; M. Veld; R.W. Schultz and J. Komen, 2002. Hand-stripping of semen and semen quality after maturational hormone treatments, in African catfish *Clarias gariepinus* . Aquaculture, 213: 373-386.

Żarski, D.; A. Horváth; J.A. Held and K.D. Kucharczyk, 2015. Artifcial reproduction of Percid fshes. In: Kestemont P. Dabrowski K. Summerfelt R (eds.), Biology and culture of percid fshes. Springer Dordrecht, 123-161.

Zhuo, Q.; Y. Zhang; W. Huang; X. Liu and Y. Li, 2011. Gonadotropin releasing hormone analogue multiple injection potentially accelerated testicular maturation of male yellow catfsh (Pelteobagrus furidruco Richardson) in captivity. Aquacul. Res. 42: 1-14.

تأثير الحقن بمستخلص الغدة النخامية وهرمون الأفابريم علي الكفاءة التناسلية للقرموط الأفريقى

احمد عبدالله عبد الرحمن على[١]، محمد السيد فرج[٢]،
عادل فتحى[٣]

[١، ٣] قسم بحوث التفريخ وفسيولوجيا الاسماك.

[٢] قسم بحوث التربيه والوراثة.

المعمل المركزي لبحوث الثروة السمكية بالعباسة – الشرقية – مصر.

الملخص العربى

استهدف هذا البحث دراسة تأثير الحقن بمستخلص الغدة النخامية للمبروك وتركيزين من هرمون الأفابريم علي الكفاءة التناسلية للقرموط الأفريقي. استخدم لذلك البحث ٩٠ سمكة قرموط أفريقي (٤٥ سمكة انثى، ٤٥ سمكة ذكر) تم تقسيمهم الى ثلاث معاملات وكل معاملة قسمت الي ثلاث مكررات :

المعاملة الاولى ١٥ ذكر + ١٥ أنثى تم حقن الإناث بمعدل (٤مجم/ كجم) والذكور تم حقنهم بمعدل (٢مجم/ كجم) بمستخلص الغدة النخامية للمبروك العادى وتم توزيع الاسماك فى ثلاث تنكات بمعدل ٥ اسماك إناث + ٥ اسماك ذكورلكل تنك.

المعاملة الثانية ١٥ ذكر + ١٥ أنثى تم حقن الإناث بمعدل (واحد ملي /كجم) والذكور تم حقنهم بمعدل (نصف ملي/ كجم) بهرمون الأفابريم و تم توزيع الاسماك فى ثلاث تنكات بمعدل ٥ اسماك إناث + ٥ اسماك ذكورلكل تنك.

المعاملة الثالثة ١٥ ذكر + ١٥ أنثى تم حقن الإناث بمعدل (نصف ملي /كجم) والذكور تم حقنهم بمعدل (ربع ملي /كجم) بهرمون الأفابريم وتم توزيع الاسماك فى ثلاث تنكات بمعدل ٥ اسماك إناث + ٥ اسماك ذكورلكل تنك .

اظهرت النتائج ما يلى:

الزمن بين الحقنة الأولي والتبويض كان أسرع وأفضل في المعاملة الثانية والثالثة (١ ملجم ونصف ملجم هرمون/كجم).

ايضا حدثت زيادة معنوية لإجمالى كمية البيض وإجمالى كمية الزريعة ونسبة الفقس في الحقن الهرموني الأفابريم بالمقارنة بمستخلص الغدة النخامية للمبروك العادى.

كذلك حدثت زيادة معنوية لكمية البيض /سمكة وعدد البيض /سمكة وعدد الزريعة /سمكة في الحقن الهرموني الأفابريم بالمقارنة بمستخلص الغدة النخامية للمبروك العادى.

كذلك تكلفة انتاج ١٠٠٠ زريعة كانت المعاملة الثالثة (حقن الإناث بهرمون الأفابريم بمعدل نصف ملي / كجم وحقن الذكور بمعدل ربع ملي / كجم) اقل تكلفة تلاها المعاملة الثانية مقارنة بالمعاملة الاولى.

لذلك نوصى بإستخدام هرمون الأفابريم فى حقن اسماك القرموط الامريكى بمعدل نصف ملي / كجم للإناث وربع ملي / كجم للذكور.