

ECONOMIC EVALUATION OF FOUR HORMONAL PREPARATIONS IN THE ARTIFICIAL PROPAGATION OF *Heterotisniloticus*(Cuvier, 1829)

ABSTRACT

The economic evaluation of four hormonal preparations: *Heterotisniloticus* pituitary extract, ovaprim, *Clarias gariepinus* pituitary extract and carp pituitary extract (C.P.E) in artificial propagation of *Heterotisniloticus* was investigated. Total of twenty four fishes (twelve females and twelve males) of twenty four months old were used for the experiment. The females were divided into four groups. Each group was induced to spawn with the same hormone. Sperm from one male was used to fertilize the eggs obtained from individual females. Effects of the hormones on the fecundity were investigated to help address the economic values. The results showed that the cost of inducing 2.20kg female to yield 30.33g, 47.00g, 30.00g and 29.33g of eggs, were ₦200, ₦700, ₦300 and ₦480, for *Heterotisniloticus* pituitary extract, ovaprim, *Clarias gariepinus* pituitary extract and C.P.E, respectively. Profitability index for *Heterotisniloticus* pituitary extract, ovaprim, *Clarias gariepinus* pituitary extract and C.P.E was 7, 10, 6.8 and 6.6, respectively. Indicating that, cost of production accounted <10% for ovaprim, <15% for CPE, and <14% for both HnPE and CgPE of the total variable cost. The production was more profitable with ovaprim than HnPE, CgPE and C.P.E. The study has provided data, comparing the effectiveness of the hormones, revealing that the four hormones can be used for artificial propagation of *H. niloticus* with varied degree of economic implication. However, ovaprim is highly recommended to hatchery users for optimum performance.

Keywords: *H. niloticus*, hormones and economic evaluation.

INTRODUCTION

The process in agricultural production system as in other sectors of the economy requires that some cost is incurred. This may be due to some scarce resources that attract high prices hence, the need for cheaper non-conventional alternatives. The factors of production in aquaculture are traditionally classified into breeding facilities, labor, capitals and managements. The contributors to cost of aquaculture production includes the returns to all factors committed to production, such as the wages of hired labors, rents on land or hatching facility, interest on capitals, cost of machines hired and expenses on feeds for the hatched fingerlings in fishery enterprise (Asangusung *et al.*, 2020).

The success in large-scale production of any organism for human consumption demands, that the resources be easily renewable. It is clearly disadvantageous to cultivate any organism when the supply of the young cannot be easily replenished (Asangusung and Uka, 2016). The high demand for fish fingerlings in the phenomenal growing aquaculture industry has stimulated the need for artificial propagation of cultured warm water fishes, as statistics of global fish production shows that fish farming represents about 15% of the global fish yields and was expected to exceed 20% by the year 2000 (FAO, 2016).

The African bonytongue "*Heterotisniloticus*" belongs to the family – Arapaidae, order – Osteoglossidae, generally called "Bonytongue" and locally named as "Ecomog fish", with a maximum size of 100cm in its standard length (SL) and a maximum weight of 10.2kg. This fish is a pelagic fresh water dweller considered as mud feeders, which serves a purpose in aquaculture and for commercial seed also, as it is normally found in the tropics of 25-30 and 18 -22 in the Nile (Sveinsdottir, 1998). The male has anal and urogenital openings just anterior to the anal fin whereas the female has a genital orifice separate from the urinary opening. Family characteristics also include: thick scales on the body

46 with a scale-less head, a large mouth usually turned upwards, pointed pectorals and small pelvic fins, a
47 small or reduced caudal and a mosaic-like pattern of large bony scales (Aditeet *al.*, 2006; Froese and
48 Pauly, 2012).

49 Hormones are “chemical messengers in the body of living organisms”, also defined as chemicals
50 that are produced in an organ or gland and then carried by the blood to another part of the body where
51 they produce a special effect for which they were designed. The term hormone is derived from a Greek
52 word meaning “to excite”. The use of synthetics and natural hormones brings about quick ovulation,
53 high percentage of hatched fish, though synthetic hormones give higher yield than the natural hormones
54 (Asangusung and Uka, 2016).

55 The present study was initiated to ascertain the cost implication of these hormonal preparations;
56 *Heterotisniloticus* pituitary extract, ovaprim, *Clarias gariepinus* pituitary extract and C.P.E, as hatchery
57 propagation of *Heterotisniloticus* has not been in existence in Nigeria before now, because of some
58 factors. Therefore, most hatchery users find it difficult to domesticate (commercialize) the existence of
59 this species, using artificial propagation method. More often than not, the choice and cost in the use of
60 these hormonal preparations among many farmers in Nigeria is almost entirely based only on cost and
61 availability. There was therefore, need to match the commercially available hormonal preparations with
62 economic value of their usage for profitable decision and rewarding recommendations in choice of
63 hormonal preparations and most importantly the cost implication over each hormonal agents used and
64 established a suitable environmental regime that help in setting pace for the production of this species;
65 since their natural reproductive habitats (nursery grounds) are gradually going into extinction via
66 destruction of mangroves swamps in Nigeria (in the quest for wealth). Acknowledging the fact that,
67 these mangrove swamps and floodplains in fresh water environment: serves as their breeding and
68 nursery ground (Froese and Pauly, 2012).

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70 MATERIALS AND METHOD

71 Earthen pond raised 24-months old gravid brood stock were selected. All brood fish were selected
72 by external morphological characteristics, using the method of Asangusung and Uka (2016). Twelve (12)
73 males and females with average weight of 2.20kg were selected. The hormonal agents were injected
74 intramuscularly into the dorsal muscles above the lateral lines and below the anterior part of the dorsal fin
75 of each brood fish, as no scale was injured. The selected gravid females were injected with 5.0mg/kg
76 *Heterotisniloticus* pituitary extract, 0.5ml/kg ovaprim, 5.0mg/kg *Clarias gariepinus* extract and 6.0mg/kg
77 C.P.E as Treatment A, B, C and D respectively.

78 Each treatment was replicated thrice, as the injected fish were returned separately into their
79 respective 50 liters aquaria. The ovulated female were carefully caught with a hand net and held tightly
80 by two persons using wet towel. The main operator, held the spawners head with one other hand from the
81 anterior to the pectoral fin onto the genital papilla with a slight pressure. The second operator held the tail
82 of the female fish, as the hormone treatment caused the ovulated eggs to flow out easily (in a thick-jet
83 form) from the genital papilla, and the eggs were collected into a dry plastic. At completion of stripping,
84 only few eggs were ejected and some blood together with translucent eggs appeared, which was a sign
85 that all or nearly all the ovulated eggs has been released (Asangusung and Uka, 2016). The following
86 parameters were calculated:

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88 Fecundity was estimated as follows (Asangusung and Uka, 2016)

89 Fecundity (Total no. of eggs stripped per fish) = 00.00g

90 The Pseudo Gonad Somatic Index (PGSI) also taken as sensitivity to *Heterotisniloticus* pituitary
91 extract, ovaprim, *Clarias gariepinus* pituitary extract and CPE was calculated according to
92 Asangusunget *al.* (2020) thus:

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$$\text{PGSI} = \frac{\text{Weight of eggs collected by stripping}}{\text{Body wt. of injection} - \text{Wt. of stripped eggs}} \times 100$$

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97 **Evaluation of Cost Benefits Indices**

98 The following economic variables were estimated in order to ascertain the economic implication
99 of the four hormonal preparations thus:

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101 Cost of eggs produced = Number of eggs @ 2.00naira per egg

102 Number of eggs = 1g of egg counted to obtain 850eggs

103 Profit Index = Ratio of the cost of egg produced to total expenditure
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105 **Statistical analysis**

106 Data collected were compared using a one-way analysis of variance (ANOVA) and Duncan
107 Multiple Range Test (DMRT) to determine significant differences among means ($P < 0.05$).
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109 **RESULTS AND DISCUSSIONS**

110 The financial implication of the four hormonal agents used in the successful propagation of
111 *Heterotisniloticus* were significantly different ($p < 0.05$) as this was addressed by, calculating the cost of
112 brood stock, cost of facility, cost of feeding and other miscellaneous against the total outcome (financial
113 turnover) of the eggs stripped (Table 1) and compared to justify the best hormonal agent that can
114 successfully provide a farmer with a high profit. This was carried out using profitability index (PI)
115 principle, as the cost of inducing 2.20kg weight of *Heterotisniloticus* fish with HnPE, ovaprim, CgPE
116 and CPE were ₦200, ₦700, ₦300, and ₦480, respectively. The result of the economic analysis (Table
117 1) reveals that Ovaprim treated fish produced the highest number of eggs (39,950eggs) with the highest
118 profit index of 10, this was followed by HnPE treated group producing 25,780eggs with a profit index of
119 7; while CgPE and CPE treated fish gave 25,500 (PI of 6.8) and 24,930 (PI of 6.6) respectively. The
120 results of profitability index recorded in this work showed a high economic benefit with the use of
121 ovaprim when compared to those of HnPE, CgPE and CPE; as this agrees with the reports of
122 Asangusunget *al.* (2020), Oni (2017) and Ugwumba (2011).
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135 **Table 1: Economic benefit analysis of *Heterotis niloticus* injected with *Heterotis niloticus* pituitary**
 136 **extract, ovaprim, *Clarias gariepinus* pituitary extract and CPE.**

PARAMETERS	Hn.PE	Ovaprim	CgPE	CPE
Cost of Brood stock (₦)	5,000	5,000	5,000	5,000
Cost of hormone, per fish (₦)	200	700	300	480
Cost of feeding & Misc. (₦)	180	180	180	180
Cost of facilities (₦)	2,000	2,000	2,000	2,000
Total Expenditure (₦)	7,380	7,880	7,480	7,560
Total wt. of eggs produced (g) (1g of egg ≡ 850eggs)	30.33 (25,781eggs)	47.00 (39,950eggs)	30.00 (25,500eggs)	29.33 (24,931eggs)
Cost of eggs produced (₦) (1egg ≡ 2naira)	51,562	79,900	51,000	49,860
Profitability Index (₦)	51,562:7,380	79,900:7,880	51,000:7,480	24,931:7,560
	7:1 7	10:1 10	6.8:1 6.8	6.6:1 6.6

137 The average water quality parameter recorded during the study, showed no significant differences
 138 ($p>0.05$) amongst the water parameter during the experimental period. Number of environmental factors
 139 such as temperature, pH, dissolved oxygen and TDS; play decisive roles in ovulation, as temperature is of
 140 vital importance. It has been observed that activity of dosage administered actually defines the readiness
 141 of the females, their age, size, sensitivity amongst other factors (Woyhavorish and Horvath, 1980).

142 An average temperature of 28°C, dissolved oxygen of 9mg/l and a pH of 6 was recorded
 143 throughout the experiment as this conforms with the result recorded with Uka *et al.* (2019) in the effects
 144 of different synthetic hormonal preparation on fertilization and hatching in *C. gariepinus* and also
 145 validates the work of Asangusung and Uka (2016), they observed *H. longifilis* exhibiting latency period
 146 with the best results at 25-28°C. The pH of 6.00 to 8.00 was within normal range for culture fishes
 147 (Asangusung and Uka, 2016), as the pH obtained, in this study were lower than the pH obtained by
 148 Asangusung *et al.* (2018). The temperatures obtained in this study are slightly higher than the temperature
 149 obtained by Asangusung *et al.* (2018), and that of Asangusung and Uka (2016). The essence of measuring
 150 water quality in this research work was to ensure that we do not introduce variables other than the ones to
 151 be evaluated.

152 CONCLUSION

153 The result obtained, indicated the possibility of achieving a minimal cost of controlled
 154 reproduction in *Heterotis niloticus* using this hormonal preparation in stimulation of the female fish.
 155 However, ovaprim gave outstanding and impressive performance, while *H. niloticus* pituitary extract
 156 gave average performance relative to *C. gariepinus* pituitary extract and CPE.

158 ACKNOWLEDGEMENT

159 The authors are grateful to the Head of Department, Fisheries and Aquatic Resources Management,
 160 Michael Okpara University of Agriculture, Umudike, Nigeria, for providing the facilities used for this
 161 study.

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