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EFFECTS OF GONADOTROPIN-RELEASING HORMONE, HUMAN CHORIONIC GONADOTROPIN, DEXAMETHASONE, PROSTAGLANDIN-F2 ALPHA AND PROGESTERONE ON THYROID, GONAD, LIVER AND KIDNEY FUNCTIONS OF THE NILE CATFISH *"CLARIAS LAZERA"*

(With 4 Tables)

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تأثير حقن الهرمون المحرر للهرمونات الحافزة للمناسل، هرمون المشيمة الآدمي والديكساميثازون والبروستاجلاندين ف٢ ألفا والبروجستيرون على وظائف الغدد الدرقية والجنسية، وظائف الكبد والكلى في أسماك القراميط النيلية (كلاريس لازيرا)

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أجريت هذه الدراسة على ٨٠ من الذكور و ٨٠ من الإناث لأسماك القراميط النيلية "كلاريس لازيرا" أثناء فترة ما قبل الأباضة بحقن في العضل بجرعات محدده من هرمون الجسم تحت السريرى المحرر لإفراز الهرمونات الحافزه للمناسل من الغدة النخامية (GnRH) (٠,٠١ ميكروجرام / جرام من وزن الجسم) ، "هرمون المشيمة الآدمي" (hCG) (٣ وحدات دولية / جرام من وزن الجسم) ، ديكساميثازون (٠,٠١ ميكروجرام / جرام من وزن الجسم) ، هرمون البروستاجلاندين ف٢ – ألفا (٠,٢ ميكروجرام / جرام من وزن الجسم) وهرمون الحمل (البروجسترون) (١٠ ميكروجرام / جرام من وزن الجسم)على قياسات كل من معامل الجسدي المنسلى (GSI) ، هرمون ثلاثى ايود الثيرونين (T3) وهرمون الثيروكسين (T4) وهرمون الأيستراديول (E2) وهرمون البروجسترون (P4) في كل من ذكور وإناث القراميط النيلية – تم قياس تأثير حقن الهرمونات السابقة الذكر على كل من وظائف الكبد أنزيم الالانيين أمينوترانس فيراز (ALT) ، الاسبرتات امينو ترانس فيراز(AST) وكذا أنزيم الفوسفاتيز القاعدى (ALP) ووظائف الكلى (تركيز اليوريا ، حمض البوليك والكرياتينين) فى مصل أسماك القراميط وقد أوضحت هذه الدراسة إن حقن كلا من هرموني الجسم تحت السريرى المحرر لإفراز هرمونات الحاثة الجنسية من الغدة النخامية وهرمون المشيمة الآدمي (hCG,GnRH) معا ، قد أدى إلى زيادة معنوية واضحة في كل من المعامل الجسدي المنسلى، هرمونات التراى – أيودوثيرونين والأيستراديول والبروجسترون في مصل ذكور وإناث أسماك القراميط " الكلاريس لازيرا" المحقونة بالمقارنة بالمجموعات الضابطة. إن حقن كلا من

هرمون (الديكسا ميثازون والبروجسترون) معا، أعطى زيادة معنوية في كل من المعامل الجسدي المنسلي، هرمونات الغدة الدرقية (التراى – أيودوثيرنين والثيروكسين) وهرمونات الغدد الجنسية (الأيستراديول والبروجستيرون) في مصل ذكور وإناث أسماك القرامبط المحقونة مقارنة بالمجموعات الضابطة. إن الحقن المنفرد لكلا من هرمون الجسم تحت السريرى المحرر لإفراز هرمونات الحاثة الجنسية من الغدة النخامية (GnRH) وهرمون المشيمة الآدمي (hCG) وكذا حقنهما معا قد أدى إلى زيادة معنوية واضحة في كفاءة الكبد (انخفاض في مستويات أنزيمات الأسبرتات والالانين ترانس فيراز وزيادة الفوسفاتيز القاعدي في مصل كلا من ذكور وإناث اسماك القرامبط المعالجة علاوة على ذلك، أدى حقن تلك الهرمونات السابقة إلى زيادة كفاءة الكلى (انخفاض في مستويات دلالات وظائف الكلى كاليوريا، حمض البوليك والكرياتينين) في مصل كلا الجنسين لأسماك القرامبط المحقونة بالمقارنة بالمجموعات الضابطة. إن الحقن المزدوج لكل من الديكساميثازون والبروستاجلاندين ف٢ – ألفا معا وكذا حقن الديكساميثازون والبروجسترون معا أدي إلى انخفاض كفاءة الكبد (زيادة معنوية واضحة في أنزيمات الأسبرتات والالانين امينوترانسفيراز وأنزيم الفوسفاتيز القاعدي) وكذلك تدهور كفاءة الكلى (زيادة معنوية في مستويات دلالات وظائفها كاليوريا، حمض البوليك والكرياتينين) في مصل ذكور وإناث اسماك القرامبط المحقونة بالمقارنة بالمجموعات الضابطة.

SUMMARY

The present investigation was carried out on eighty male and eighty female "Clarias Lazera" fish during the prespawning period. The Clarias fish were injected intramuscularly with GnRH (0.01 ug/g b. wt.), hCG (3 I.U/g b. wt.), dexamethasone (0.01 ug/g b. wt.), PGF2 alpha (0.2 ug/g b. wt.), and progesterone (10 ug/g b. wt.). Estimation of gonadosomatic index (GSI), serum triiodothyronine (T_3), thyroxine (T_4), 17-β estradiol (E_2) and progesterone (P_4) were performed in both male and female Clarias fish. Moreover, the liver function parameters including aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) as well as kidney function parameters such as urea, uric acid and creatinine were also assayed. The combined administration of GnRH + hCG, led to a significant increase in GSI, serum levels of T_3, E_2 and P_4 in both sexes as compared to respective control values. The combined administration of dexamethasone + progesterone into male and female Clarias fish led to a maximal increase in GSI, T_3, T_4, E_2, and P_4 as compared to the respective control groups. The individual administration of GnRH or hCG, and simultaneous injection of hCG + GnRH maintain a proper liver and kidney functions. These treatments led to a reduction in serum levels of AST and ALT also, a reduction in serum urea, uric acid and creatinine was detected, as compared to the respective control values. The combined injection of dexamethasone with either PGF2α or progesterone led to deteriorative effects on both

liver and kidney functions. In conclusion, treatment with exogenous hypothalamic (GnRH) and hypophseal hormones (hCG) stimulated thyroid and gonads. Moreover, exogenous administration of dexamethasone, PGF_2 alpha and progesterone, activated thyroid and gonadal functions. Therefore selective exogenous hormonal therapy (Gn-Rh and or HCG) might lead to final gonadal maturation and consequently high fish productivity.

Key words: *GnRH, hCG, Dexamethasone and sex steroids, liver and kidney functions, Nile catfish.*

INTRODUCTION

The great increase in human population is considered as one of the most important problems in Egypt, thereby necessitating a constant increase in food supply. The protein-containing food, in particular, needs to satisfy the requirements of the growing human population. Catfish is one of the most important economic fish species in our country due to its high growth rate and cheap cost (Dowidar *et. al.*, 1985). Naturally, the interest should focus on fish as a prevailing protein-rich food element. Thus, to be able to initiate high production from fish, detailed knowledge of the reproductive process in fish, especially those being mostly cultivated, is required.

Recent aquaculture is the intensive one i.e. fish reproduction with maximal productivity. Reproduction in fish is regulated by external environmental factors that trigger internal mechanisms into action. Induced breeding, in many teleost fish, by exogenous application of gonadotropin-releasing hormone (Slater *et. al.*, 1994); gonadotropins (Eding *et. al.*, 1982), prostaglandins (Goetz 1983), corticosteroids (Richter and Van Den Hurk, 1982), or sex steroids with combination of gonadotropins (Mojazi *et. al.*, 1996 a & b and Mylonas *et. al.*, 1997), is a common practice in stimulating the final stages of gonadal maturation in teleosts. Mohamed *et. al.* (1998) showed that the exogenous prostaglandin F_2 alpha stimulates rapid ovulation and spermiation in a dose-dependent fashion. Thus, intiation of high production of fish is possible. The present work is a trail to enhance the reproductive performance of male and female catfish through exogenous interference with hypothalamic, hypophyseal, adrenal and sex steroid hormones with a special reference to thyroid, gonad, liver and kidney functions.

MATERIALS and METHODS

Experimental fish:

Eighty adult male (with an average body weight of 200g) as well as eighty adult female (with an average b. wt. of 200g) Nile catfish "Clarias Lazera" were purchased alive and in an apparently good health from a fish market in Giza governorate during the non-breeding season, November-January 2002 (El-Bolock, 1973) Fish were kept in glass aquaria (100 x 40 x 60 cm^3) supplied with dechlorinated water. Oxygenated by an electric air pumping compressor. The aquarium temperature was adjusted thermostatically, using an electric heater, at 28 ± 0.5 C° and exposed to an artificial light photoperiodicity (12 hours dark: 12 hours light) (Deleeuw *et. al.,* 1988).

Experiment I:

Eighty fish were divided into four groups as follows: -

Group I: Saline treated - control group: each of 10 males and 10 females, each fish was injected intramuscularly (I.M.) with 0.2 ml saline (0.65 % NaCl) solution, every other day for 10 days.

Group II: GnRH-treated group: each fish was injected I.M. with 0.2 ml saline every other day till the 7th day of injection. GnRH (Fertagyl*) 10 ug were dissolved in one ml saline and injected at a dose of 0.01 ug/g b.wt.fish once daily for the last three successive days (Peter, *et. al.,* 1988).

Group III: hCG-treated group: each fish was injected I.M. with 0.2 ml Pregnyl**, 3000 I.U. hCG dissolved in one ml saline and injected at a dose of 3 I.U./g b. wt fish every other day for 10 days (five times) (Miura, *et. al.,* 1991).

Group IV: hCG + GnRH-treated group: included each fish was injected I.M. with hCG 3 I.U./g b.wt., every other day, (five times) and GnRH 0.01 ug/g b.wt., as a single injection daily for the last three consecutive days (Chang *et. al.,* 1991).

Experiment II:

Eighty fish were randomly divided into four groups, each of twenty, 10 males and 10 females, as follows:

Group I: Oil treated - control group: each fish was injected I.M. with 0.2 ml olive oil, once every three days (five times).

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* Fertagyl=Intervet International B.V.Co.,Boxmeer,Holland.

** Pregnyl= Nile Pharmaceutical Co., A.R.E

Group II: Each fish was injected I.M. with 0.2 ml Dexamethasone*** (a potent synthetic corticosteroid) at a dose of 0.01 µg /g b.wt. once every three days (five times) (Richter and Van Den Hurk, 1982).

Group III: Each fish was injected. With 0.1 ml dexamethasone at a dose of 0.01 µg/g b.wt., once every three days (five times) and simultaneously injected with 0.1 ml Lutalyse**** (PGF2α) at a dose of 0.2 ug/g b. wt., as a single injection every three days (five times) (Shokr, 1996).

Group IV: Each fish was injected I.M. with 0.1 ml Lutone***** (progesterone) at a dose of 10 µg/g b.wt., once every three days (five times) (Richter *et. al.*,1985). The fish was injected simultaneously with 0.1ml dexamethasone at a dose of 0.01µg/g b.wt. once every three days (five times).

Blood sampling:

At the end of each experiment, 24 hours after the last injection, fish were taken out separately and dried carefully. Blood samples were taken by caudal puncture technique, collected into plain tubes and left to coagulate at room temperature. Serum was separated by centrifugation and kept in a deep freezer at -20°c until used.

Gonadosomatic index: (GSI)

The gonadosomatic index (GSI) was commputed as the percentage weight of the gonads to the gutted weight of the fish. (Dowidar *et. al.*, 1985).

$$GSI = \frac{\text{Wt. of the gonads}}{\text{Gutted wt. of the fish}} \times 100$$

Hormonal assays:

Radioimmunoassay technique, using RIA kits was used for determination of serum levels of the following hormones:

1- Serum total triiodothyronine (T_3) was determined according to Hollander and Shenkman (1974).
2- Serum thyroxine (T_4) was determined according to the method of Refetoff (1979).
3- Serum 17B-estradiol (E_2) was determained according to the method of Xing *et. al.*, (1983).

*** Dexamethasone: Amriya Pharmaceutical Industries Co., Alexandria, Egypt
****Lutalyse: UPJOHN S.A.Co. Pmurs – Belgium.
***** Lutone: Misr Co. for Pharmaceutical Industries, S.A.A

4- Serum progesterone (P_4) was determined according to the method adopted by Kubasik *et. al.*, (1984). Hormonal assays were estimated by using radioimmunoassay solid phase component system; ICN, CO, USA.

Biochemical analysis:

1-Liver function tests:

a- Determination of serum aminotransferase activities AST&ALT were performed according to Reitman and Frankel (1957).

b- Determination of serum alkaline phosphatase activity (ALP) according to the method adopted by Hausdman *et. al.*(1967).

AST, ALT & ALP were assayed colorimetrically using commercial kits (Randox, U.K).

2-Kidney function tests:

a- Determination of serum urea concentration, according to the method of Potton and Crouch (1977).

b- Determination of serum uric acid concentration, according to the method adopted by Triwedi *et. al.* (1978).

c- Cetermination of serum creatinine concentration, according to Husdan and Rapoport (1968).

Urea, uric acid & creatinine were estimated using commercial kits purchased from Bio-Merieux Co-Mary-L-Etoile, Chorbonnteres, Les-Brain, France.

Statistical analysis:

All data were subjected to statistical analysis of variance (ANOVA) according to the procedures reported by Snedecor and Cochran (1980). LSD was calculated and taken in consideration only, where F-value was significant.

RESULTS

Results of the present investigation are recorded in Tables 1-4.

DISCUSSION

The data of the present study, revealed that intramuscular administration of (hCG + GnRH) into male and female "Clarias Lazera" fish induced a significant increase in the gonadosomatic indices, triiodothyronine (T_3) and serum sex steroid hormones (esteradiol and progesterone) in both sexes as compared to their respective control at ($P < 0.05$). As the thyroid hormones appear to influence gonadal development and maturation particularly in the female teleosts

(Hurlburt, 1977), the gonadotrophins and gonadal hormones affect the thyroids (Leatherland, 1982). Indeed there is an evidence that the mammalian pituitary gonadotrophins, FSH and LH stimulate fish thyroid activity and plasma (T_4) values (Matty, 1985 and Yaron *et. al.* 2003). This explains, the increase in thyroid hormones in the present investigation, especially T_3 (the most active thyroid hormone). On the contrary, the role of thyroid hormone administration in stimulating the release and secretion of teleost gonadotrophins was clearly reported by previous investigators (Higgs *et.al.*, 1982, Ueda *et. al.*, 1984 and Cyr and Eales, 1996). In sturgeon, Dettlaf and Davydova (1979) concluded that injection of triiodothyronine (T_3) along with pituitary extract facilitated maturation and spawning of fish on a production scale. In the goldfish, Carassius auratus, T_3 and T_4 were required for normal gonadal maturation, probably as a factor regulating gonadal metabolism rather than gametogenesis (Hurlburt, 1977).

Concerning the effect of single injection of hCG and GnRH in the present study, there were no alterations in T_3, T_4 and gonadal hormon levels. Eales (1982) and Ueda *et. al.*, (1984) suggested that there was a direct relationship between thyroxine and elevation of serum sex steroids in fish. Tagawa *et. al.*, (1994) found that both plasma concentrations of thyroxine (T_4) and triiodothyronine (T_3) were high in both sexes of Chum salmon during the spawning season (GSI was high) and were relatively lower throughout early gonadal maturation phase (GSI was low). Additionally, Cyr and Eales (1996) and Timmermans *et. al.* (1997) found that thyroid hormones stimulated the testicular activity spermatogenesis, spermiogenesis and androgen production in male teleost fish. The combined injection of hCG + GnRH into Clarias fish clearly stimulated T_3 and sex steroid hormones secretion (Table 1). Hurlburt (1977) and Kumakura *et. al.* (2003) reported that thyroxine enhanced ovarian development in the intact goldfish, but it had no influence on hypophysectomized regressed adult fish. The ovarian response to salmon gonadotrophin was enhanced by T_4 indicating that thyroid hormones might act synergestically with exogenous gonadotrophins (GTH) rather than acting directly on stimulating pituitary function (Mylonas *et. al.*, 1994). Moreover, immersion or injection of T_4 and T_3 into dam broodstock fish (Lam, 1994) or injection of gold striped amberjack fish, *Seriola lalarandi* broodstock fish with T_3 primed by hCG + salmonid pituitary homogenate (Tachihara *et.al.*, 1997) led to improvement of the survival and growth rates of fry, but the fertilization and hatching rates were not affected.

The elevated level of serum estradiol hormone in male Clarias fish, following hCG + GnRH administration might indicate an increase in serum testosterone production followed by aromatization and consequently elevation in serum 17-β estradiol in male fish. The results of the present study agree with those obtained by Trudeau *et. al.* (1991) who demonstrated that testosterone propionate, through aromatization to 17-β estradiol, can increase pituitary responsiveness to exogenous LH-RH analogue in gonad-intact male and female gold-fish. Moreover, the results are in agreement with those obtained by Slater *et. al.* (1994) in male Sockeye salmon and by Mojazi *et. al.* (1996a) in male Sturgon hybrid as they found that plasma testosterone concentration was higher throughout the sexual maturation (pre-spawning) season, while plasma, rostenedione and 17-β estradiol concentrations were much higher throughout the breeding season.

The data of the present study revealed that (hCG + GnRH) treatment of male and female Clarias fish led to elevation of serum 17-β estradiol concentrations in both sexes. The explanation of this increase in male is that hCG, or "ICSH" (luteinizing hormone) stimulates steroidogenesis by acting at two principal sites (Veldhuis, 1991).

Concerning the effect of exogenous administration of corticosteroids, or prostaglandins and progesterone on thyroid and gonad functions in Clarias fish, the present results table 2, revealed that injection of dexamethasone solely or in combination with prostaglandin-F_2alpha led to a significant increase in gonadosomatic indices of male and female Clarias fish at $P<0.05$. Additionally, the most potent effect was revealed with the combined administration of dexamethasone with progesterone (Table 2) that led to conspicuously significant elevations in GSI, T_3, T_4, estradiol and progesterone values of male and female-treated groups, as compared to their respective control groups at $P<0.05$. Data of the present study (table 2) show that dexamethasone injection alone was more affective in female fish than in male fish. Also, the results revealed that dexamethasone had no effect on both thyroid and gonadal functions in male fish, whereas it had a stimulatory action on their activities in female fish. Our results are in agreement with those of Richter and Van Den Hurk (1982) who found that administration of 11-deoxycorticosterone acetate (DOCA) into African catfish led to maturation of post vitellogenic oocytes and post ovulatory oocytes measuring more than 1 mm in diameters. They also added that oocyte maturation, but not ovulation, had been induced by 11-deoxycorticosterone. Also, 11-DOCA had been shown to be fairly

effective in inducing oocyte maturation in vitro in brook trout and yellow perch (Goetz and Theofan, 1979). The production of corticosteroids in fish species requires the presence of 21-hydroxylase. This enzyme has been identified in ovaries of certain marine teleosts (Colombo *et. al.*, 1978) but not in the ovary of zebra fish (Lambert and Van Den Hurk, 1982). However, Barry *et. al.* (1995) when they used 11-deoxycorticol and 11-deoxycorticosterone on the in vitro maturation of Walleye fish oocytes, found that these steroids at a high dose (10 ng/ml) stimulated germinal vesicle breakdown (GVBD) of ovarian oocytes.

Regarding the role of corticosteroids on male reproduction in fish, data presented in table 2, revealed that short-term administration of dexamthasone into male Clarias fish did not alter hormonal profile of thyroids and gonads, but increased the GSI. Consten *et. al.* (2001a,b) showed that long-term cortisol treatment caused an inhibition of pubertal development, by affecting directly, or indirectly, all components of the brain-pituitary-gonadal (BPG) axis of male common carp. GnRH content of the brain was decreased and testicular development, reflected by gonadosomatic index and the first wave of spermatogenesis, was retarded. The data present in table 2, clarified that combined injection of dexamethasone + PGF2α, increased GSI, serum T_3 and T_4 in female Clarias fish. Gobbetti *et. al.* (1995) showed that corticosterone modulated by PGF2α is implicated in the reproductive processes with different roles. The present results are in agreement with Gobbetti *et. al.* (1991) who reported a simultaneous increase in PGF2α and 17-β estradiol which suggestes a PGF2α-dependent estradiol synthesis in female oviparous Triurus carnefex. Mahmoud *et. al. (*1995) and Shokr (1996) indicated that PGF2α achieved rather artificial ovulation and spermiation in *Talapia aurea* than gonadal maturation. Concerning the administration of dexamthasone + progesterone (Table 2) into Clarias fish, results revealed a maximum significant increase in GSI, serum T_3, T_4, 17-β estradiol and progesterone in all treated groups as compared to the respective control values. Dexamethasone might have had a synergetic action with progesterone resulting in enhancement of thyroid and gonadal activities. The present results are in agreement with those of Mojazi *et. al.* (1996b) who suggested that 17, 20β-dihydroxy-4-pregnen-3-one (17, 20β-P) is a maturation-inducing steroid in Sturgeon. They attributed the failure of spontaneous oocyte maturation and ovulation in cultured Sturgon to the low level of (17, 20β-P) throughout the year. Moreover, Barry *et. al.* (1995) induced in vitro maturation of Wallays fish oocytes induction of germinal vesicle breakdown (GVBD)

by using (17, 20β-P) and 17α -20Pγ, 21-trihydroxy-4-pregnen-3-one Ismail (1999) induced *Clarias lazera* oocytes maturation in vitro by addition of exogenous hCG followed by addition of progesterone derivatives such as Δ^5 -pregnen-3β-01-20 one or 4-pregnen-20β-01-20 one.

Data presented in this study (Table 3) revealed that individual administration of GnRH or hCG and simultaneous injection of (hCG + GnRH), led to reduction in serum levels of AST and ALT and elevation of serum alkaline phosphates (ALP) in both male and female Clarias Lazera fish. Previously mentioned exogenous treatment led to the reduction serum urea, uric acid and creatinine in both sexes of Clarias fish as compared to respective control values. The present results are in agreement with those obtained by Lenhardt, (1992) who found that changes in some blood chemistry parameters as well as hepatosomatic and gonadosomatic indices were associated with changes in gonadotrophins in the blood of pike fish, Esox lucius from the river Danube. The increased serum alkaline phosphates activity in the present investigation could reflect an increased metabolic activity caused by hypothalamic and pituitary hormones. This is in agreement with the findings of Ellsaesser and Clem (1987) and Mona *et. al.* (1995).

Data presented in this investigation (Table 4) revealed that combined injection of dexamethasone + PGF2 alpha and also the administration of dexamethasone + progesterone led to deteriorating effects on liver and kidney efficiencies. Manifested by elevated activates of ALT and AST as well as increased blood concentration of urea, uric acid and creatinine in both sexes as compared with respective control values.

These results are in agreement with those obtained by Mahmoud *et. al.* (1995) and Mohamed *et. al.*, (1998) on PGF_2 alpha-treated Oreochromis aureus and Oreochromis niloticus, Tilapia fish. The increase of the transaminases activities in Clarias serum, may be attributed to the damage which have taken place in liver. Sunny *et. al.* (2002) reported that the activates of AST and ALT might be stimulated or inhibited following the administration of sex steroids.

The increase in serum urea, uric acid and creatinine concentrations after injection of dexamethasone + PGF_2 α or dexamethasone + progesterone may be due to higher activities of endocrine glands regulating kidney functions with lowering in kidney efficacy and glomerular filtration rate owing to renal damage (Lockhart and Metnar, 1984; Trigari et. al., 1985 and Mohamed *et. al.*, 1998).

In conclusion, treatment with exogenous hypothalamic (GnRH) and hypophseal hormones (hCG) could be stimulate the thyroids and gonads. Liver and kidney functions. While exogenous administration of corticosteroids, prostaglandin F2 α and progesterone, enhanced thyroidal and gonadal functions, but reduced gonadal maturation. So, higher fish production could be achieved by selective exogenous hormonal therapy.

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Table 1: Effect of exogenous administration of gonadotropin-releasing hormone (GnRH), human chorionic gonadotropin (hCG), and combination of both hormones on average gonadosomatic index (GSI), serum thyroid and gonad hormones of the Nile catfish, "Clarias lazera".

Parameters / Groups	Gonadosomatic Index %		Triiodothyronine (T3) ng/dl		Thyroxine (T4) µg/dl		17-β Estradiol (E2) Pg/dl		Progesterone (P4) ng/dl	
	M	F	M	F	M	F	M	F	M	F
Control saline 0.65% Nacl	0.24^{a} ± 0.010	1.08^{a} ± 0.002	65.88^{a} ± 0.45	70.70^{a} ± 0.44	1.76 ± 0.03	2.77 ± 0.03	25.50^{a} ± 0.04	735.00^{a} ± 3.90	0.30^{a} ± 0.03	0.32^{a} ± 0.033
0.01 GnRH µg/g.b.wt	0.39^{c} ± 0.004	1.28^{b} ± 0.002	65.06^{a} ± 0.21	70.79^{a} ± 0.54	1.70 ± 0.04	2.78 ± 0.03	65.30^{c} ± 0.30	740.10^{a} ± 2.59	0.33^{a} ± 0.03	0.66^{c} ± 0.03
hCG 3 I.U /g.b.wt	0.31^{b} ± 0.010	1.40^{c} ± 0.002	66.00^{a} ± 0.23	70.50^{a} ± 0.26	1.75 ± 0.04	2.76 ± 0.03	48.30^{b} ± 0.30	739.02^{a} ± 3.70	0.34^{a} ± 0.03	0.44^{b} ± 0.02
GnRH (3 I.U /g.b.wt) + hCG(0.01µg/g.b.w)	0.47^{d} ± 0.004	1.98^{d} ± 0.002	68.90^{b} ± 0.42	72.88^{b} ± 0.25	1.73 ± 0.04	2.75 ± 0.05	73.80^{d} ± 0.33	1540.00^{b} ± 3.03	1.02^{b} ± 0.04	0.88^{d} ± 0.04
F- Value	132.76**	32780**	13.81**	7.65**	0.77	0.08	6345.4**	15790.6**	107.76**	58.60**
LSD	0.02	0.007	1.00	1.19	N.S.	N.S.	0.77	9.20	0.10	0.09

n = 10 Mean ± S.E. M = Male F = Female ** P < 0.05

N.S. = Non significant.

Mean values having the same letter within the same column are non significantly different from each other at P < 0.05

Table 2: Effect of exogenous administration of dexamethasone alone and in combination with prostaglandin F_2- alpha, or progesterone on gonadosomatic index (GSI), serum thyroid and gonad hormones of the Nile catfish,"Clarias lazera".

Parameters / Groups	Gonadosomatic Index %		Triiodothyronine (T3) ng/dl		Thyroxine (T4) µg/dl		17-β Estradiol (E2) Pg/dl		Progesterone (P4) ng/dl	
	M	F	M	F	M	F	M	F	M	F
Control olive oil	0.31[a] ± 0.002	1.01[a] ± 0.020	73.00[a] ± 0.31	57.60[a] ± 0.22	2.16[a] ± 0.05	2.60[a] ± 0.04	28.37 ± 0.30	715.60[a] ± 1.30	0.35[a] ± 0.04	1.00[a] ± 0.003
Dexamethasone 0.01 µg/g.b.wt	0.44[b] ± 0.002	1.58[c] ± 0.004	74.20[a] ± 0.43	59.50[b] ± 0.30	2.20[a] ± 0.03	2.70[b] ± 0.05	468.20[b] ± 4.04	1550.00[b] ± 25.50	0.36[a] ± 0.04	1.53[b] ± 0.03
Dexamethasone (0.01 µg/g.b.wt) + PGF2α (0.2 µl/g.b.wt)	0.58[c] ± 0.002	1.21[b] ± 0.021	74.80[a] ± 0.38	60.00[b] ± 0.39	2.20[a] ± 0.04	2.78[b] ± 0.04	480.90[b] ± 11.02	736.00[a] ± 3.06	0.38[a] ± 0.04	1.08[a] ± 0.03
Dexamethasone (0.01 µg/g.b.wt) + Progesterone (10 µg/g.b.wt)	1.00[d] ± 0.002	3.51[d] ± 0.022	88.70[b] ± 0.40	68.50[c] ± 0.40	3.31[b] ± 0.05	3.94[c] ± 0.04	1153.80[a] ± 17.00	2090.10[c] ± 24.10	1.40[b] ± 0.04	1.66[c] ± 0.04
F- Value	19070**	3885**	323.70**	220.0**	166.8**	204.99**	2021.11**	1382.00**	150.60**	116.31**
LSD	0.006	0.05	1.17	0.97	0.12	0.10	29.627	50.92	0.12	0.088

n = 10 Mean ± S.E. M = Male F = Female ** P < 0.05

N.S. = Non significant.

Mean values having the same letter within the same column are non significantly different from each other at P < 0.05

Table 3: Effect of exogenous administration of gonadotropin-releasing hormone (GnRH), human chorionic gonadotropin (hCG), and GnRH in combination with hCG on serum levels of some parameters indicative of liver and kidney functions of the Nile catfish, "Clarias lazera".

Parameters / Groups	Liver Function test						Kidney function test					
	AST U/L		ALT U/L		ALP U/L		Urea mg%		Uric acid mg%		Creatinine mg%	
	M	F	M	F	M	F	M	F	M	F	M	F
Control saline 0.65% Nacl	71.40^{c} ± 1.82	93.6^{c} ± 1.07	17.40^{c} ± 0.45	21.6^{c} ± 1.00	6.40^{a} ± 0.86	7.00^{a} ± 1.15	22.00^{c} ± 0.47	21.00^{c} ± 1.78	9.02^{c} ± 0.20	19.2^{c} ± 1.61	2.37^{c} ± 0.09	3.32^{c} ± 0.12
GnRH 0.01 µg/g.b.wt	66.00^{c} ± 3.87	72.0^{b} ± 1.98	12.80^{b} ± 0.39	18.1^{b} ± 0.86	9.80^{b} ± 0.61	8.60^{a} ± 1.22	13.96^{b} ± 1.40	18.10^{bc} ± 1.89	4.82^{b} ± 0.11	15.0^{b} ± 1.23	1.69^{b} ± 0.12	3.00^{c} ± 0.21
hCG 3 I.U /g.b.wt	53.80^{b} ± 2.30	59.8^{a} ± 3.82	9.40^{a} ± 0.26	13.00^{a} ± 0.79	12.40^{b} ± 0.96	11.00^{a} ± 1.08	11.36^{a} ± 0.60	13.80^{ab} ± 2.43	3.74^{a} ± 0.62	10.4^{a} ± 1.72	1.48^{b} ± 0.05	2.46^{b} ± 0.06
GnRH(0.01µg/g .b.wt)+hCG (3 I.U /g.b.wt)	43.4^{a} ± 1.82	53.4^{a} ± 3.61	8.80^{a} ± 0.57	10.00^{a} ± 1.78	17.60^{c} ± 1.28	15.80^{b} ± 1.77	9.28^{a} ± 0.35	12.00^{a} ± 0.84	2.86^{a} ± 0.39	9.60^{a} ± 1.13	1.22^{a} ± 0.07	1.66^{a} ± 0.09
F- Value	23.415 **	38.344 **	82.518 **	19.388 **	24.420 **	8.280 **	46.817 **	4.961 **	50.670 **	9.823 **	31.158 **	30.486 **
LSD	7.447	8.207	1.248	3.374	2.744	3.828	2.338	5.245	1.100	4.145	0.254	0.378

n = 10 Mean ± S.E. M = Male F = Female ** P < 0.05

Mean values having the same letter within the same column are non significantly different from each other at P < 0.05

Table 4: Effect of exogenous administration of dexamethasone alone and in combination with prostaglandin F_2- alpha, and progesterone on serum levels of some parameters indicative of liver and kidney functions of the Nile catfish, "Clarias lazera".

Parameters / Groups	Liver Function test						Kidney function test					
	AST U/L		ALT U/L		ALP U/L		Urea mg%		Uric acid mg%		Creatinine mg%	
	M	F	M	F	M	F	M	F	M	F	M	F
Control olive oil	76.00^{a} ± 4.13	95.00^{a} ± 6.15	18.00^{a} ± 1.51	22.20^{a} ± 0.57	7.36^{a} ± 0.32	7.88^{a} ± 0.34	24.10^{a} ± 0.50	22.50^{a} ± 0.82	10.66^{a} ± 0.52	20.0^{a} ± 0.94	2.60^{a} ± 0.05	3.78^{a} ± 0.07
Dexamethasone 0.01 µg/g.b.wt	86.20^{b} ± 1.16	100.0^{a} ± 4.71	19.20^{a} ± 1.10	23.00^{a} ± 1.24	10.10^{b} ± 0.56	9.50^{a} ± 0.37	25.30^{a} ± 0.77	23.20^{a} ± 1.73	11.78^{a} ± 0.41	22.5$^{a b}$ ± 0.74	2.80^{a} ± 0.04	4.06^{b} ± 0.11
Dexamethasone (0.01 µg/g.b.wt) + PGF2α (0.2 µl/g.b.wt)	110.0^{c} ± 4.71	129.60^{b} ± 2.45	23.00^{b} ± 0.76	26.20^{b} ± 0.90	13.50^{c} ± 1.33	12.08^{b} ± 1.26	27.90^{b} ± 0.58	25.00^{a} ± 0.21	15.00^{b} ± 0.47	25.2^{b} ± 1.12	3.12^{b} ± 0.12	4.56^{c} ± 0.04
Dexamethasone (0.01 µg/g.b.wt) + Progesterone (10 µg/g.b.wt)	130.0^{d} ± 2.11	147.80^{c} ± 2.67	26.00^{b} ± 0.87	29.00^{c} ± 0.42	18.48^{d} ± 0.81	16.04^{c} ± 0.65	30.50^{c} ± 0.45	28.56^{b} ± 0.62	18.16^{c} ± 0.80	31.8^{c} ± 1.02	3.66^{c} ± 0.08	4.88^{d} ± 0.07
F- Value	52.154 **	34.205 **	11.078 **	13.537 **	31.799 **	22.171 **	23.489 **	7.168 **	35.020 **	28.586 **	35.661 **	41.343 **
LSD	9.643	12.274	3.151	2.436	2.422	2.170	1.688	2.906	1.641	2.729	0.222	0.220

n = 10 Mean ± S.E. M = Male F = Female ** P < 0.05

Mean values having the same letter within the same column are non significantly different from each other at P < 0.05