

Effect Of Oxytocin on Pituitary Gland in Relation to Reproduction in The Fish, *Cyprinus Carpio* (L.)

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Abstract— *Oxytocin is a neurohypophysial hormone. It is also known as love hormone as it plays a role in mating behavior and sexual response. It is made in magnacellular neurosecretary cells in the supraoptic nucleus and paraventricular nucleus of the hypothalamus and is released in to blood from the posterior lobe of pituitary gland. In the present study, Oxytocin / Isotocin were injected 1.5ml/kg body weight for one week at every alternate day in the fish, Cyprinus carpio. It has been observed that oxytocin showed stimulatory effect on ovary, stimulates the sexual behavior and gonadotrophs were increased in number. Thus it had been concluded that oxytocin can be used as a stimulant in fish breeding to achive early maturity and is associated with induction of spawning reflexes in the fish Cyprinus carpio.*

Index Terms— *Oxytocin, Isotocin, Spawning reflexes, neurohypophysial hormone gonadotroph.*

I. INTRODUCTION

Oxytocin act as a love hormone or trust hormone as it predicts the level of bonding between mother and child. It also initiates as well as maintains female sexual behavior. Oxytocin infusion facilitates feminine behavior. Plasma oxytocin level increases during sexual arousal in both women and men are significantly higher during orgasm/ejaculation then during prior base line testing. Oxytocin increased the sperm numbers in the ejaculate which would be beneficial to reproductive techniques. In addition to effect in sexual behavior, it has been also shown to increase cervical contractions, modulations of sperm production and transport (Bales K.L. *et al.*, 2004). Isotocin, the fish homologue of oxytocin, has received little study in terms of the regulation of behavior since the early reports of Hoyle, 1999; Pickford G. E. and Strecker E.L., 1977. They reported that peripherally injected isotocin had an effect on behavior, but it was simply due to minimal binding to

argentine vasotocin (AVT) receptors (Pickford G. E. and Strecker E. L., 1977). Recently, it has been shown that central isotocin has different effect from vasotocin with regard to the neural activity that drives humming behavior in the plainfin midshipman fish (Goodson J. L. and Bass A.H. 2000). Very little attention has been given to action of the oxytocin like principles though there is evidence for isotocin receptors in both gills and liver of trout (Evans, 1998). Isotocin stimulates the testosterone secretion in the testes of trout *in vitro* (Rodringuez and Specker, 1991 and Rupasree B. *Etal* (2019)) though it remain to be shown whether this reflects an action of vivo of the synthetic hormone or local paracine effect as have been reported in the associated with induction of the spawning reflex. Studies on the efficacy of oxytocin on reproductive behavior in relation to pituitary gland in the fish, *Cyprinus carpio* is meager and hence the present work is an attempt in this direction to assess its potency as an inducer to achieve early maturity.

II. MATERIALS AND METHODS

Cyprinus carpio were collected, reared in a fibre glass tanks and acclimatized to the laboratory conditions. The experiment was carried out for one week. Control and experimental groups were formed. Fishes from control groups were injected with 1.5ml of distilled water and experimental groups were injected with 1.5ml of oxytocin at every alternate day for one week, intramuscularly. At the end of the experiment, male and female of control and experimental group were sacrificed to study the histomorphological changes in pituitary gland.

III. OBSERVATION/RESULTS

- Control group: At the end of the experiment, the survival rate of control fish was 100%. The average weight length and girth of fish was 605gm, 25cm and 24cm resp. The pituitary gland of control

group consisted of cyanophil, chromophobes and acidophils. In the proximal portion of pars distalis, there were cyanophils as seen from their affinity towards AF and PAS-stain. These cyanophil cells were angular or spindle in shape.

- Experimental group: At the end of the experiment, the survival rate of experimental fish was 100%. The average weight length and girth of fish was 610gm, 26cm and 26cm resp. In the pituitary gland of experimental group the number of cyanophil cells was increased throughout the PPDas compared to that of the control fish. Some cyanophils were turgid with granular cytoplasm and some were in the secretory phase. Some gonadotrops were vacuolated.

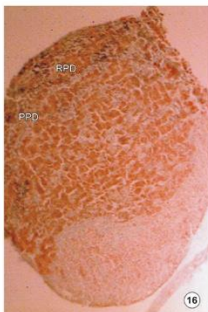


Fig. 16 :Section of pituitary gland showing rostral pars distalis, proximal pars distalis. AF stain. X10.0²

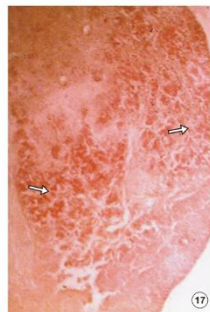


Fig. 17 :Section of pituitary gland showing dorsal (→) and ventral proximal pars distalis (←). X 100²

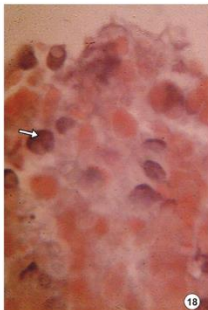


Fig. 18 :Pituitary gland showing turgid cyanophils. (→) AF stain. X100.0²

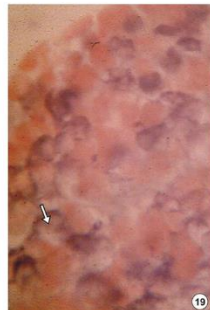


Fig. 19 :Pituitary gland showing completely discharged gonadotrops (→)AF stain. X 100.0²



Fig. 69 :After the treatment, male and female exhibiting the courtship.

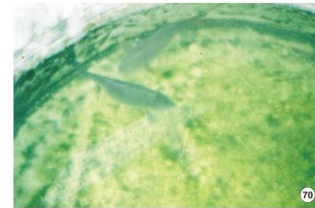


Fig. 70 :Male choosing the female.



Fig. 71 :Eggs are attached to the roots of aquatic plant *Jalukumbhili* after spawning.

IV. DISCUSSION

In rodents oxytocin stimulates the spermatogenesis to increase the sperm number in the ejaculate, improves sperm quality and quantity (Huseyin, 2005) which would benefit all assisted reproductive techniques used in animals and also initiate female sexual behavior (Millen Hess, 2002). Very little information is available on the role of oxytocin in fish reproduction. In mammals, oxytocin is known to play an important role in almost all aspects of reproduction, including social recognition (Dluzenmet *et al.*, 2000), the formation of pair bond (Cushing, B. S. and Carter, C. S, 1999), the physical act of mating (Gorzalka and Lester, 1987), Parturition (Fuchs and Fuchs 1984), maternal behaviour (Kendrick *et al.*, 1997).Oxytocin also stimulates the sexual receptivity and reproductive behavior. Very little information is available on the role of oxytocin in fish reproduction. Isotocin, the fish homologue of oxytocin has received little attention in terms of the regulation of sexual behaviour.Pickford and Strecker(1977) reported that peripherally injected isotocin had an effect on behavior but it was simply due to minimal binding to argentine vasotocin receptor but recently, it has been shown that central isotocin has

different effect from vasotocin with regard to the neural activity, that drives humming behaviour in the plainfin midshipman fish (Goodson and Bass, 2000). Michael Black *et al.*, 2004, reported that the reproductive behaviour of *Lythrypnusdalli* changes from female to male following the removal of a dominant male from a social group. On the basis of the above literature, the present investigation is an attempt to establish the role of oxytocin on pituitary gland in relation to reproduction in the fish *Cyprinus carpio*. In the present study, after the dose of oxytocin, secretion of gonadotrophs increased. Oxytocin plays a definite role in fish reproduction. The mammalian homologue for isotocin is oxytocin, has been reported to promote female sexual behavior in rats and in fishes (Bale, T.L. *et al.*, 2001). Courtship is stimulated by the gonadal hormones as well as pituitary hormone which have been observed on the basis of the histological structure of pituitary gland. In the present study, oxytocin used to stimulate early maturity in the fish, *Cyprinus carpio*.

V. SUMMARY

The objective of the present study was to evaluate the effect of oxytocin on pituitary gland in the fish, *Cyprinus carpio* in relation with reproduction. The present work was carried out not only for academic purpose but also to study its application in the field of aquaculture and will be the boon for fish farmers which can be advantageous to bring seed productivity to an economically profitable level. Oxytocin used in the present study showed early maturity, increased gonadotrophs loaded with secretion. Oxytocin showed stimulatory effect on the pituitary gland to early maturity in the fish, *Cyprinus carpio*. Thus, it can be concluded that utility of hormone like oxytocin can be used as a stimulant in fish breeding to achieve early breeding.

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