CHANGES IN BLOOD GONADOTROPIN LEVEL IN MATURE FEMALE CARP FOLLOWING HYPOPHYSIAL HOMOGENATE INJECTIONS

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ABSTRACT

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A hypophysial homogenate injection increased blood gonadotropin level in adult female carp and maintained it at that level for three days after injection.

The blood gonadotropin level in adult female carp seems to be dependent on the physiological condition of the ovary expressed by the relation of old oocytes with a completed vitellogenesis process to the new ones, and the relation of the oocytes with the nucleus shifted to the periphery to those with a centrally placed nucleus.

INTRODUCTION

Only scanty information is available in literature on the dynamics of gonadotropin release with respect to fish reproduction. Apart from numerous histological observations of the pituitary, rough indications concerning the quantitative content of gonadotropin in the pituitary were determined by Swift and Pickford (1965) in the perch, by Fontaine and Chauvel (1961) in the Atlantic salmon, by Barr and Hobson (1964) in the plaice *Pleuronectes platessa*, and more recently in *Mystus vitatus* by Singh (1970). The most potent gonadotropic activity was observed shortly before spawning and the lowest one in the time of gonadal inactivity.

More recent developments of radioimmunoassay (RIA) for cyprinid and salmonid gonadotropins (Breton et al., 1972; Crim et al., 1973) allowed measurement of GTH in the blood and enabled a better understanding of GTH secretion during the end of the reproductive cycle. In *Oncorhynchus gorboscha* blood gonadotropin level is the highest during ovulation and spermatation (Crim et al., 1973) as in *Carassius carassius* (Breton et al., 1972), and in the rainbow trout (Fostier et al., 1978).

In *Oncorhynchus nerka*, *Salmo salar*, *Salvelinus fontinalis* and *Salmo*

trutta a low blood gonadotropin level was found during the early stages of ovarian and testicular development, whereas an increase in female blood gonadotropin level occurred at the onset of vitellogenesis, as well as in the blood of both sexes during ovulation and spermatation (Crim et al., 1975).

This indicates an increase in the plasma GTH at the onset of ovulation which occurred normally in salmonid fishes kept in aquaria. In carp, spawning never takes place in such conditions and is generally induced by hypophysation treatment. Thus, it was interesting to analyse the evolution of GTH in the blood after injections of pituitary extracts. In practice it has been shown that not all females subjected to hypophysation spawn. The aim of this study was to analyse plasma GTH in fishes which spawned and in those which did not.

MATERIAL AND METHODS

Studies were conducted on 36 six-year-old female carp of the same stock, weighing 3–5 kg. At the start of the experiment in June 1976, after vitellogenesis in natural conditions, there were six females which had spawned in June 1975 as a result of carp hypophysial injections, 10 females which had spawned naturally a year before (spawning was under observation and females were examined following spawning) and 20 females which had not spawned in the previous season in spite of hypophysation.

The experiment lasted from 7 June 1976 to 7 July 1976, average water temperature in ponds being about 20°C. On 7 June 1976, all the females were injected with carp hypophysial homogenate (4 mg dry hypophysis/kg body weight). On the following day (8 June 1976) 16 of the 36 females spawned (fish eggs were pressed out by abdominal massage).

To summarize the results, experimental fishes were divided into the following groups:

I: females which spawned in June 1975 and June 1976 — 5 fish

II: females which spawned only in June 1975 — 10 fish

III: females which spawned only in June 1976 (during the experiment) — 11 fish

IV: females which spawned neither in June 1975 nor in June 1976 — 10 fish.

Blood samples were taken on 7 June (day 0), 8 June (day 1), 10 June (day 3), 11 June (day 4), and July 6 (day 30) by caudal puncture. After coagulation, sera were separated by centrifugation. Carp GTH was determined by the radioimmunoassay technique (Breton et al., 1974).

RESULTS

Prior to hypophysial homogenate injection, the blood gonadotropin level in the first three groups ranged from 0.86 ng/ml (Group I) to 1.80 ng/ml (Group III), while in Group IV it was 3.54 ng/ml (Fig. 1).

On the first day after injection females in all groups showed a rapid in-

Fig. 1. Changes in blood gonadotropin level in mature female carp following hypophysial homogenate injections. 0—30 = days after injection; arrow = day of injection; I—IV = group of fish.

crease in blood gonadotropin level, reaching the highest value (261.28 ng/ml) in Group I and the lowest (123.99 ng/ml) in Group III.

On the third day after injection, a decrease in the blood gonadotropin level ranging from 54.75 ng/ml (Group III) to 163.97 ng/ml (Group I) was observed.

On the fourth day after injection of females of Groups I, II and III, a decrease in blood gonadotropin level was observed, from 0.24 ng/ml in Group I females to 3.70 ng/ml in the Group III females, i.e. to about the

level found before the injection. In the Group IV females a repeated increase in the blood gonadotropin level to 91.5 ng/ml was found.

After 30 days the blood gonadotropin level in the first three groups ranged from 0.24 ng/ml (Group I) to 1.44 ng/ml (Group III), while in Group IV it was 4.92 ng/ml.

DISCUSSION

From the results of these experiments it can be inferred that carp hypophysial homogenate injections (4 mg dry pituitary/kg body weight) induce a marked increase in blood gonadotropin level in mature female carps during spawning. This increase was maintained for three days in the females which had spawned in the year preceding the experimental period, and at least for four days in those which failed to spawn in this period.

From these experiments it can be seen that changes in the blood gonadotropin level observed following hypophysial homogenate injection followed a similar course in Groups I, II and III in females which had spawned on 8 June 1976, and differed from those in females which failed to spawn in this period (Group IV). On the third day after injection a marked decrease in the blood gonadotropin level was found in females of Groups I, II and III, although the level still remained higher than before injection. In Group IV females, the level rapidly increased.

During the subsequent 27 days a decrease in blood gonadotropin level compared with the level on the first day after injection was found in all groups, although in Group IV it was found to be considerably higher than in the other three groups.

The results obtained suggest that blood gonadotropin level in the peripheral blood circulation of female carp may depend on the physiological condition of its ovary. In the case of spawned females, their ovaries can take up gonadotropin from the blood stream to stimulate maturation processes. The ovaries of unspawned fish are blocked, which results in an inhibition of early maturation processes in the oocytes (Bieniarz and Epler, 1976) and in all likelihood no gonadotropin uptake occurs. Generally speaking, a decrease in the level of a given hormone in the peripheral blood stream cannot be accounted for by its uptake by the target organ. However, considering the large mass of mature ovaries (about 15% of body weight) and the small blood mass (about 2% of body weight), it is suggested that blood gonadotropin level is dependent on this hormone uptake or on a failure of the ovary to take up gonadotropin.

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