

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
 ISSN Online: 2617-4707
 NAAS Rating (2026): 5.29
 IJABR 2026; 10(8): 789-792
www.biochemjournal.com
 Received: 07-06-2026
 Accepted: 10-07-2026

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Induced breeding of goldfish (*Carassius auratus*) using synthetic hormone

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i8j.9778>

Abstract

In the present study, female brooders were administered Wova-FH at doses of 0.5, 0.6 and 0.7-ml kg⁻¹ body weight in T₁, T₂, and T₃, respectively, while male brooders received 0.25, 0.30 and 0.35 ml kg⁻¹ body weight, respectively. Each treatment was maintained in triplicate and the brooders were stocked in breeding hapas at a male-to-female ratio of 2:1. The fecundity recorded under Wova-FH treatment was 3322 ± 104.64, 5023 ± 143.02, and 4460 ± 139.10 eggs in T₁, T₂, and T₃, respectively, with significant differences among treatments ($p < 0.05$). Fertilization rates were 57.96 ± 0.65%, 67.98 ± 0.26%, and 65.41 ± 0.20%, while hatching rates were 51.08 ± 0.32%, 64.83 ± 0.17%, and 57.22 ± 0.41% in T₁, T₂, and T₃, respectively. For Ovate, female brooders were administered 0.5, 0.6 and 0.7-ml kg⁻¹ body weight in T₁, T₂, and T₃, respectively, with three replicates for each treatment. Fecundity was 3785 ± 114.72, 6551 ± 122.88, and 4279 ± 126.32 eggs in T₁, T₂, and T₃, respectively. The corresponding fertilization rates were 68.12 ± 0.26%, 76.10 ± 0.41%, and 70.60 ± 0.35%, while hatching rates were 57.99 ± 0.59%, 72.42 ± 0.52%, and 65.76 ± 0.40%, respectively. Overall, the highest fecundity, fertilization rate, and hatching rate were recorded at 0.6 ml kg⁻¹ body weight (T₂) for both hormones.

Keywords: Gold fish, Wova-FH, Ovate, induced breeding

Introduction

The goldfish, *Carassius auratus* (Linnaeus, 1758), is one of the oldest domesticated ornamental fishes and remains among the most widely traded aquarium species worldwide. The expansion of the aquarium industry is further supported by increasing urban interest, with several cities planning the establishment of new public aquaria while private demand continues to rise steadily. Economically, the ornamental fish industry represents a substantial global enterprise.

Centuries of intensive selective breeding and crossbreeding have produced more than a hundred recognized varieties that differ strikingly in body shape, fin morphology, colour patterns and special features such as telescopic eyes, cranial “wen” growth, or absence of dorsal fin (Lorenzoni *et al.*, 2007) [4]. Goldfish show great diversity in caudal fin form (e.g., fantail, veiltail, divided caudal fins), body depth (egg shaped forms due to shortened vertebrae) and skin and scale characteristics (metallic, matte and nacreous types) Colouration ranges from metallic red, orange, yellow and white to black and bi or tricoloured forms, and is strongly influenced by the distribution of dermal chromatophores and dietary carotenoid intake Considerable progress has been achieved in the standardization of captive breeding techniques for a wide range of freshwater ornamental species. The precise combination of temperature variations, photoperiod shifts, water depth, and vegetation that naturally initiate reproductive behaviour is frequently hard to replicate in indoor tanks. Because of this, broodstock may reach apparent gonadal maturity but fail to spawn, spawn irregularly, or show a long latency between courtship and egg release, which complicates hatchery planning and results in unpredictable seed production (Sharma *et al.*, 2011) [11].

Moreover, fecundity, fertilization rate, hatching success, and fry survival can all vary greatly during spawning. In small-scale ornamental hatcheries, these parameters are rarely optimized simultaneously and are influenced by broodstock nutrition and conditioning, sex ratio, tank design, spawning substrates, and water quality (Madhu *et al.*, 2020) [5]. Inadequate management of temperature, aeration, fungal infections, and egg adhesion during incubation

can significantly lower hatching success. In this context, the present study was undertaken to evaluate the breeding response of *Carassius auratus* through Wova-FH and Ovotide under controlled captive conditions

Materials and Methods

Experimental Site: The present study was conducted from January 2026 to March 2026 in cement tanks at the Instructional Fish Farm, College of Fisheries, Odisha. The breeding experiments involved both the hapa system and stripping method for inducing spawning in goldfish (*Carassius auratus*).

Collection and maintenance: Healthy, disease-free advanced fingerlings and broodstock of goldfish intended for the controlled breeding trials were procured from two source the State Fish Farm, Bhubaneswar and a local commercial market in Kolkata during the first week of October 2025. Following procurement, the fish were transported to cement tanks maintained at the Instructional Fish Farm, where they were subjected to standardized broodstock management practices throughout the experimental period. Prior to stocking, the water quality of the experimental tanks was assessed to ensure suitability for holding the broodstock, and the fish were gradually acclimatized to prevailing tank conditions rather than introduced abruptly. Strict disinfection procedures were followed before fish introduction to minimize the risk of pathogen transfer, after which suitable males and females were selected from the maintained stock for inclusion in the breeding trials, with stocking initiated during October.

Feeding management was structured in two distinct phases to support broodstock conditioning. Initially, fish were offered a commercial ornamental feed twice daily. This regimen was subsequently supplemented with a formulated diet comprising rice bran and groundnut oil cake in equal proportions (1:1), fortified with essential vitamins and minerals to meet nutritional demands associated with gonadal development. During the first four months, feeding was maintained at 4% of body biomass per day, divided equally across two feeding intervals; this rate was later reduced to 2% of body weight per day to curb excessive lipid deposition in the abdominal region, a condition known

to compromise reproductive performance in broodstock. Periodic manure application was additionally employed to stimulate phytoplankton and zooplankton proliferation within the rearing tanks, thereby supplementing the formulated diet with a natural food source.

Identification of Female and Male Brood fish: For the purpose of this investigation, healthy and sexually mature broodfish, specifically those exceeding one year of age, were carefully selected for breeding trials. Female brooders were identified on the basis of several morphological and physiological indicators of reproductive readiness. A characteristically swollen, soft, and pliable abdomen most pronounced in the ventral region along with the visible outline of the ovaries on either side of the abdomen, served as primary selection criteria. The presence of a distinctly pinkish, congested vent further confirmed spawning readiness. Additionally, females' fish were identified by pointed and delicate pectoral fin. Male brooders were selected based on observable secondary sexual characteristics, including a flattened abdomen and a laterally compressed body profile. Readiness for breeding in males was confirmed by the spontaneous discharge of milt upon the application of gentle pressure to the abdomen. Males were further differentiated from females by their notably larger and coarser pectoral fins, which served as a reliable morphological marker for sex identification during the preparation of induced breeding trials.

Hormone source: Hormones were administered by gently removing the brood fish from the conditioning tank with a net and placing them on a sponge. They were then wrapped in a soft, damp towel and the syringe was administered around the base of the pectoral fin. Gold fish spawners were injected using a 1.0 cc graduated syringe. The synthetic hormones Ovotide and Wova-FH) were used in this investigation.

Experimental design: The present study was conducted following a Completely Randomized Design (CRD) comprising three treatment groups, with each treatment replicated three times.

Hormones	Treatments	Female	Male
Wova-FH	T ₁	0.5 ml/kg of body weight	0.25 ml/kg of body weight
	T ₂	0.6 ml/kg of body weight	0.3 ml/kg of body weight
	T ₃	0.7 ml/kg of body weight	0.35 ml/kg of body weight
Ovotide	T ₁	0.5 ml/kg of body weight	0.25 ml/kg of body weight
	T ₂	0.6 ml/kg of body weight	0.3 ml/kg of body weight
	T ₃	0.7 ml/kg of body weight	0.35 ml/kg of body weight

Collection of brooders for administration of hormone:

Selection of brood fish for the induced breeding trials was carried out with particular attention to reproductive maturity, with suitable individuals identified from stock maintained in cement tanks. Following selection, males and females were segregated and housed separately in hapas to preclude premature or uncontrolled spawning ahead of hormonal administration. Individual body weight was recorded for each brood fish, as this parameter formed the basis for determining the precise, sex-specific dosage of the inducing hormone to be administered. To obtain an accurate estimate of true body weight, the tare weight of the hand net used during handling was pre-recorded and subsequently

subtracted from the gross weight, yielding the net body weight employed in all subsequent dosage calculations.

Hormone administration: Prior to the commencement of breeding trials, Wova-FH and Ovotide were stored under recommended conditions to preserve their hormonal efficacy. Brood fish were segregated by sex and individually weighed to record their initial body weights. All experimental sets were initiated during the early morning hours. Hormonal doses were calculated based on the individual body weight of each brooder, and injections were administered intraperitoneally using insulin syringes to ensure dosage precision. The doses of both hormones varied

from 0.5 to 0.7 ml per kg body weight for females and 0.25 to 0.35 ml per kg body weight for males, with the aim of identifying the optimal dose for eliciting the best spawning response. Following hormonal administration, the brood fish were released into the designated breeding hapas.

Response Time: The Response time or latency period refers to the interval between hormone administration and the initial signs of spawning. This period was recorded in hours. **Egg Count Estimation:** To estimate the total number of eggs released, a 2 ml sample of water-hardened eggs was collected and counted. This process was repeated three times with different sub-samples. Excess water was removed using a strainer. The average number of eggs per sample was calculated, scaled up to one litre, and multiplied by the total volume of water-hardened eggs to estimate the total egg count.

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Fertilization Rate: Fertilization percentage was determined for each treatment group by examining water-hardened eggs. Three sub-samples were collected per breeding set and the number of fertilized eggs (n) out of the total eggs (N) in each sample was counted to calculate the fertilization rate. The fertilization percentage was then calculated by using the standard method.

Hatching Percentage: Hatching percentage is defined as the proportion of fertilized eggs that successfully hatched into spawn. To determine this, the number of hatchlings in 1 ml of sample was counted and then extrapolated to calculate the total number of hatchlings from the entire volume collected. This value was used to estimate the overall hatching rate.

Analysis of water quality parameters: Throughout the experiment, water quality parameters like temperature, pH, DO, alkalinity and hardness were recorded as per standard procedure (Table-1).

Statistical analysis: The significant difference in treatments at various doses of hormone were tested through one way ANOVA at 5% level of significance. Student t-test is used to know the significant difference in breeding parameters between Wova-FH and Ovatide.

Results and Discussion

Details of the breeding responses to Wova-FH and Ovatide are presented in Table-2 and Table-3 respectively. The fecundity of *Carassius auratus* varied within the treatments administered with the hormone Wova-FH. The fecundity was found to be T₁ (3322 ± 104.64), T₂ (5023 ± 143.02) and T₃ (4460 ± 139.10). The fecundity of induced *Carassius auratus* was found to be significantly (p<0.05) within the treated tanks. The fertilization rate of egg was found to be 57.96 ± 0.65%, 67.98 ± 0.26%, and 65.41 ± 0.20% in T₁, T₂ and T₃ respectively. Hatching rate 51.08 ± 0.32%, 64.83 ±

0.17%, and 57.22 ± 0.41 for fertilized eggs was obtained in T₁, T₂ and T₃ respectively. The hatching rate and fertilization rate were affected by different doses of hormones in present investigation. The present study indicates that, both the hatching rate and the fertilization rate were increased in treatment T₂. Similarly, the female Gold fish broods were administered with the hormone Ovatide at a rate 0.5, 0.6 and 0.7 ml/kg body weight under the treatment T₁, T₂ and T₃ having three replicates respectively. The fecundity of *Carassius auratus* varied within the treatments administered with the hormone Ovatide. The fecundity was found to be T₁ (3785 ± 114.72), T₂ (6551 ± 122.88) and T₃ (4279 ± 126.32). The fecundity of induced *Carassius auratus* administered with the hormone Ovatide at different doses was found to be significantly (p<0.05) within the treated tanks. The fertilization rate of egg was found to be 68.12 ± 0.26%, 76.10 ± 0.41%, and 70.60 ± 0.35% in T₁, T₂ and T₃ respectively. Hatching rate 57.99 ± 0.59%, 72.42 ± 0.52%, and 65.76 ± 0.40 for fertilized eggs was obtained in T₁, T₂ and T₃ respectively. The hatching rate and fertilization rate were affected by different doses of hormones in present investigation. The above results indicate that the significantly (p<0.05) higher fecundity, fertilization rate and hatching rate were recorded from the treatments of Ovatide. Further among the treatments of Ovatide, significantly superior result obtained at T₂.

Mahadevi *et al.* (2018)^[6] suggested Wova-FH at 0.7 ml per kg body weight for male and 1.4 ml per kg body weight for the female is the ideal dose for inducing *Carassius auratus*. Rahaman *et al.*, (2011)^[9] reported highest fecundity, fertilization and hatching rate in Comet gold fish by inducement of ovaprim at 0.7 ml/kg body weight with double dose to female. In the present study, it was also seen that fecundity increased with increase in size of female fish (r = 0.99). It is observed that the colour of fertilized eggs was transparent initially and changed to creamy as the embryonic development proceeded and the similar observations were reported by Haniffa *et al.* (2006)^[3] in Koi carp. Mondal *et al.* (2018)^[8] reported about the induced breeding of gold fish (*Carassius auratus*) in controlled environmental condition and its breeding success rate along with fecundity of 6400 per 100g of female. Malik *et al.* (2014)^[7] induced Koi carp using 0.2 ml/kg for males and 0.5 ml/kg for females, resulting in 9930 eggs/kg body weight. Begum *et al.* (2022)^[2] compared reproductive outcomes between koi carp and goldfish using Ovaprim-C at 0.5 ml/kg for females and 0.1 ml/kg for males, reporting substantially higher fecundity in koi carp (17,000-18,000 eggs) relative to goldfish (4,500-5,000 eggs), a difference likely attributable to inherent species-specific variation in ovarian capacity and body size. Mahadevi *et al.* (2018)^[6] reported that Wova-FH at a dose of 1.4 ml/Kg and 0.7 ml/kg was found to be effective for female and male respectively with 74% fertilization and 82% hatching rate. Begum *et al.* (2022)^[2] found that 74% fertilization rate and 57% hatching rate using Ovaprime C hormone at a dose of 0.5 ml/kg body weight in gold fish breeding in captive condition. Basudha *et al.* (2017)^[1] conducted an experiment on the induced breeding of *B. dero* using Wova-FH and reported a fertilization rate of 87.33% and a hatching rate of 87.73% at a hormone dose of 0.5 mL kg⁻¹ body weight of female. Generally, induced breeding occurred with temperature around 28 °C (Rokade *et al.*, 2004)^[10] confirms the present study.

Table 1: Water quality parameters (Mean $\pm$ SD) of cement tanks

Parameters	Tank-1	Tank-2	Tank-3
Water temperature ($^{\circ}$ C)	26.6 $\pm$ 0.50	26.5 $\pm$ 0.40	26.6 $\pm$ 0.50
pH	7.62 $\pm$ 0.29	7.70 $\pm$ 0.23	7.65 $\pm$ 0.33
Dissolved oxygen (ppm)	6.32 $\pm$ 0.60	6.20 $\pm$ 0.46	6.19 $\pm$ 0.54
Alkalinity (ppm)	158.33 $\pm$ 16.9	162.50 $\pm$ 15.6	165.83 $\pm$ 15.3
Hardness (ppm)	158.75 $\pm$ 6.75	158.00 $\pm$ 3.85	158.91 $\pm$ 4.51

Table 2: Details of breeding response of *Carassius auratus* to Wova-FH (Mean $\pm$ SD)

Treatments	Size of female (g)	Size of male (g)	Fecundity	Fertilisation (%)	Hatching (%)
T ₁	90 $\pm$ 0.81	80.83 $\pm$ 4.81	3322 $\pm$ 104.64	57.96 $\pm$ 0.65	51.08 $\pm$ 0.32
T ₂	92 $\pm$ 1.63	82.66 $\pm$ 4.57	5023 $\pm$ 143.02	67.98 $\pm$ 0.26	64.83 $\pm$ 0.17
T ₃	93 $\pm$ 0.81	85.16 $\pm$ 2.96	4460 $\pm$ 139.1	65.41 $\pm$ 0.20	57.22 $\pm$ 0.41

Table 3: Details of breeding response of *Carassius auratus* to Ovatide (Mean $\pm$ SD)

Treatments	Size of female (g)	Size of male (g)	Fecundity	Fertilisation (%)	Hatching (%)
T ₁	92 $\pm$ 0.82	81.33 $\pm$ 4.81	3785 $\pm$ 114.72	68.12 $\pm$ 0.26	57.99 $\pm$ 0.59
T ₂	93 $\pm$ 0.82	80.33 $\pm$ 2.86	6551 $\pm$ 122.88	76.12 $\pm$ 0.41	72.42 $\pm$ 0.52
T ₃	94 $\pm$ 1.63	80.66 $\pm$ 4.34	4279 $\pm$ 126.32	70.60 $\pm$ 0.35	65.76 $\pm$ 0.40

Conclusion

The study systematically evaluated the effectiveness of synthetic hormonal preparations in inducing reproductive performance in goldfish (*Carassius auratus*), with particular emphasis on Ovatide and Wova-FH. The findings demonstrated that both the type of hormone and its dosage significantly influenced breeding success in *Carassius auratus*. Based on the experimental results, induced breeding of goldfish is suggested during February using either Ovatide or Wova-FH at a dose of 0.6 ml kg⁻¹ body weight.

References

- Basudha CH, Singh NG, Devi NS, Sinthoileima CH. Induced breeding and embryonic development of an indigenous fish, *Bangana dero* (Hamilton) in captivity using Wova-FH. *International Journal of Fisheries and Aquatic Studies*. 2017;5(1):428-432.
- Begum M, Ali PA, Siraj M, Riaz M, Wahab A, Baset A. Incaptive culturing of goldfish and koi carp in Punjab, Pakistan. *Natural and Applied Sciences International Journal (NASIJ)*. 2022;3(2):42-52.
- Haniffa MA, Benziger PSA, Arockiaraj AJ, Nagarajan M, Siby P. Breeding behaviour and embryonic development of koi carp *Cyprinus carpio*. *Journal of Bio-Science*. 2006;14:121-125.
- Lorenzoni M, Corboli M, Ghetti L, Pedicillo G, Carosi A. Growth and reproduction of the goldfish *Carassius auratus*: A case study from Italy. In: Gherardi F, editor. *Biological invaders in inland waters*. 2007. p. 259-273.
- Madhu K, Rema Madhu, Gopakumar G, Mohandas MP, Vijayan MT, Baby ST. Marine ornamental fishes and their breeding: CMFRI initiatives. In: *Blue Bonanza*. 2020. p. 131-148.
- Mahadevi SF, Antony C, Bhosale MM, Gopalakannan A, Gnanavel K. Induced breeding of telescopic eye gold fish (*Carassius auratus*) using synthetic hormone (Wova-FH). *Journal of Entomology and Zoology Studies*. 2018;6(3):1368-1373.
- Malik A, Abbasi AR, Kalhoro IB, Shah SA, Narejo NT, Kalhoro H. Effect of Ovaprim hormone Syndel Laboratory, Canada on spawning of koi carp at fish hatchery Chilya Thatta, Sindh, Pakistan. *Sindh University Research Journal (Science Series)*. 2014;46(3):273-276.
- Mondal A, Singh P, Mondal M, Singh M, Tripathi G, Tripathi GS. Comparative study of gold fish (*Carassius auratus*) breeding via induced and natural breeding. *International Journal of Chemical Studies*. 2018;6(6):1940-1944.
- Rahaman SM, Mahmud Z, Ahmed F, Ghosh AK, Sabbir W. Induced breeding, embryonic and larval development of comet gold fish *Carassius auratus*. *Electronic Journal of Biology*. 2011;7(2):32-39.
- Rokade P, Ganeshwade RM, Somwane SR. A comparative account on induced breeding of major carp *Cirrhinus mrigala* by pituitary extract and Ovaprim. *Journal of Environmental Biology*. 2006;27(2):309-310.
- Sharma JG, Chakraborty C, Chakrabarti R. Water quality parameters for culture of goldfish *Carassius auratus*. *International Journal of Fisheries and Aquaculture*. 2011;3(8):151-155.