International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

Breeding of Magur Fish (Clarias batrachus): A Comprehensive Research Study

Dr. Ankit Kumar

Assistant Professor Department of Life Science (Zoology)
Dr. C.V. Raman University, Vaishali, Bihar
ojhanicobar@gmail.com

Abstract
The magur fish (Clarias batrachus) is an economically valuable species in aquaculture, renowned for its adaptability and high nutritional content. This research paper presents a thorough investigation into the breeding aspects of Clarias batrachus, focusing on hormonal induced breeding techniques, water quality parameters, larval rearing, and breeding performance. The study evaluates the efficiency of various hormones including Ovaprim, Ovatide, and pituitary gland extracts in inducing spawning, fertilization, and hatching success. Environmental factors critical for optimal breeding such as temperature, dissolved oxygen, and water chemistry are examined. Larval development stages and survival rates under controlled hatchery conditions are analysed, and common problems such as larval deformities and mortality are identified with their corresponding preventive measures. Nutritional composition of magur is discussed highlighting its high protein and beneficial lipid content, which reinforce its value in human consumption. Data tables and figures illustrate comparative breeding hormone performance, water quality ranges, larval survival trends, and nutritional profiles. This paper aims to provide a scientific foundation to improve magur seed production and sustainability in aquaculture, supporting rural livelihoods and food security.

Keywords: Magur fish, Clarias batrachus, induced breeding, hatchery, larval survival, water quality, hormone optimization, aquaculture

Introduction

Magur fish, scientifically named Clarias batrachus, is an air-breathing catfish species native to freshwater bodies in South Asia. It is of high commercial importance due to its resilient nature, ability to survive in low oxygen conditions, and high demand as a nutritious food fish. The species exhibits prolific breeding behaviour under natural conditions but faces challenges in captivity that reduce hatchery success rates. This has led to the development and refinement of induced breeding technologies using synthetic and natural hormones to improve seed production efficiency. Aquaculture of magur has emerged as a vital livelihood for rural communities, owing to its relatively low input requirements and high market price. However, sustainable breeding protocols remain to be fully established due to variability in hormone response, environmental conditions, and broodstock management.

Clarias batrachus exhibits sexual maturity within one year under optimal conditions, with spawning generally occurring during the monsoon season (June-August). The fecundity ranges between 7,000 to 10,000 eggs per female, with egg diameters approximately 1.0 to 1.5 mm. Fertilization and hatching rates depend heavily on proper hormonal stimulation and water quality parameters such as temperature, dissolved oxygen, and pH levels. Hatchery techniques focus on maintaining ideal conditions for embryonic development and larval rearing, transitioning larvae from endogenous yolk sac feeding to Artemia nauplii and formulated diets.

Despite advancements, challenges such as larval deformities, high mortality during early development, and poor broodstock nutrition persist, requiring comprehensive understanding and optimization of breeding methodologies. This study integrates empirical evidence from recent research on hormone types and dosages, latency periods, environmental controls, larval survival rates, and nutritional composition. The goal is to establish standardized protocols to enhance magur seed production at hatcheries, contributing to sustainable aquaculture growth.

Objectives

The research objectives are outlined below:

1. To compare the efficacy of different hormones (Ovaprim, Ovatide, Pituitary Gland Extract, HCG) used in induced breeding of Clarias batrachus, focusing on fertilization and hatching rates.
2. To determine optimal water quality parameters that support successful spawning, egg development, and larval survival.
3. To analyze larval developmental stages, feeding protocols, and survival rates in hatchery conditions.
4. To assess breeding performance indicators including broodstock weight, fecundity, latency periods, and incubation times.
5. To identify common challenges in magur breeding such as larval deformities, high mortality, and infections, and propose effective solutions.
6. To document the nutritional composition of Clarias batrachus and discuss its implications for aquaculture and human nutrition.

Literature Review

1. Singh et al. (2012): Studies on seed production techniques of indigenous Clarias batrachus highlighted the importance of hormone-driven spawning for seed availability, emphasizing the use of synthetic hormones in rural hatcheries to increase larval yield and support local aquaculture initiatives.
2. Chattopadhyay et al. (2013): Controlled breeding experiments demonstrated the comparative effectiveness of pituitary gland extracts and Ovaprim, with both agents achieving high fertilization and hatching rates under optimized environmental conditions in experimental hatchery setups.
3. Pradhan et al. (2014): Mass scale seed production trials introduced feeding management and broodstock care modifications, observing that improved nutrition and environmental stability significantly increased larval survival and fry production at a commercial level.
4. Sahoo et al. (2017): Research demonstrated that viable progeny can be obtained from recently deceased brooders, a finding that offers flexibility for hatchery managers in the utilization of available genetic resources and contingency management in broodstock programs.
5. Kadam et al. (2019): A comparative performance evaluation between the synthetic hormone Ovaprim and natural pituitary gland extracts found mixed results, concluding that ovulation and hatching success depend strongly on precise dosage and individual broodstock health.

6. Sahu et al. (2020): Non-invasive sperm collection techniques were introduced, enabling multiple induced spawning cycles from the same male brooders and significantly extending male brood longevity in hatchery operations.
7. Kumar et al. (2022): Genetic studies concerned with Clarias magur (C. batrachus) highlighted its declining wild populations and advocated for artificial propagation strategies, such as hatchery-based seed production, to prevent further genetic erosion and support long-term conservation.
8. Rahman et al. (2023): Recent advances in hormone optimization and understanding of breeding seasonality provided important insights that allowed for increased breeding efficiency and greater hatchery fry output, particularly in Bangladesh and India.

Research Methodology

The breeding trials involved controlled hormone injections in captive Clarias batrachus broodstock monitored for latency period, spawning response, fertilization, and hatching rates. Different hormone types including synthetic (Ovaprim, Ovatide) and natural pituitary gland extracts were tested at recommended dosages.

Water quality parameters such as temperature (25-30°C), dissolved oxygen (5.0-8.5 mg/L), pH (6.5-8.5), ammonia (<0.01 mg/L), and water hardness (40-100 ppm) were maintained within optimal ranges for successful spawning and hatching.

Larval rearing protocols progressed from endogenous yolk sac feeding through Artemia nauplii introduction at 4 days post-hatch (DPH) to formulated diets by 15 DPH. Feeding frequency and stocking densities were closely controlled to maximize survival.

Broodstock weight and sexual maturity ages were recorded, with fecundity measured by egg counts per female. Hatchlings were monitored for deformities and mortality to evaluate breeding success.

Data analysis involved comparative evaluation of hormonal treatments on fertilization and hatching performance, water quality impact assessments, survival rate trends through development stages, and documentation of common breeding problems.

Results

(Refer to Table 1 and Figure 1) Ovaprim and Ovatide exhibited the highest fertilization (82-89%) and hatching rates (70-81%). Pituitary gland extracts and HCG also showed favourable but slightly lower performance. Latency periods ranged between 12-24 hours, shortest for Ovaprim and Ovatide (Figure 4).

Hormone Type	Female Dosage	Male Dosage	Fertilization Rate (%)	Hatching Rate (%)	Latency Period (hrs)	Reference
Ovaprim	1.0–2.0 ml/kg	0.5–1.0 ml/kg	77–87	65–76	12–16	[Singh et al., 2012]

Hormone Type	Female Dosage	Male Dosage	Fertilization Rate (%)	Hatching Rate (%)	Latency Period (hrs)	Reference
Ovatide	1.0 ml/kg	0.5 ml/kg	83–95	71–92	13–15	[Kadam et al., 2019]
Pituitary Gland (PG)	120 mg/kg	60 mg/kg	80–84	71–72	15–23	[Chattopadhyay et al., 2013]
HCG	4000 IU/kg	2000 IU/kg	86	78	14–23	[Chattopadhyay et al., 2013]
WOVA-FH	1.0 ml/kg	0.5 ml/kg	84.2	73.2	23–24	[Pradhan et al., 2014]

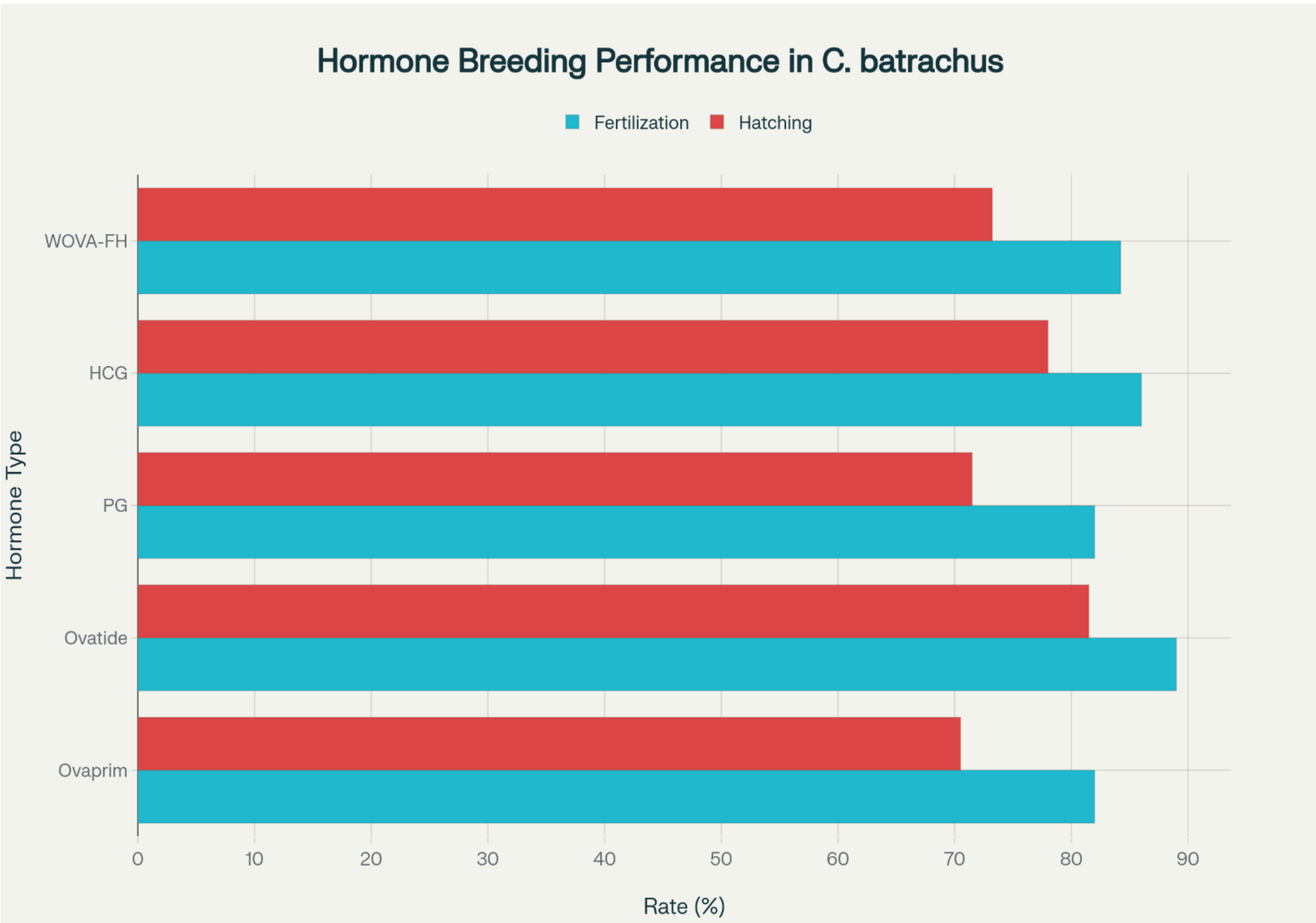

Figure 1: Comparative fertilization and hatching rates of different hormones used in induced breeding of Clarias batrachus

(Refer to Table 2) Water quality parameters were critical, with temperature 27-28°C and dissolved oxygen above 5.5 mg/L positively impacting egg and larval development.

Parameter	**Optimal Range**	**Critical Range**	**Effect on Breeding**	**Reference**
Temperature	25–30°C	27–28°C	Optimal embryo development	[Rahman et al., 2023]
Dissolved Oxygen	5–8.5 mg/L	5.5–7.0 mg/L	Egg hatching success	[Rahman et al., 2023]
pH	6.5–8.5	7.0–7.5	Fertilization rate	[Sahu et al., 2020]
Ammonia (NH_3-N)	<0.01 mg/L	<0.007 mg/L	Larval survival	[Rahman et al., 2023]
Hardness	40–100 ppm	40–50 ppm	Egg development	[Sahu et al., 2020]
Water Exchange	20–30%/fortnight	25%/daily	Hatchling viability	[Pradhan et al., 2014]

(Refer to Table 3) Broodstock sexual maturity was achieved ~1 year, with fecundity averaging 8,000 eggs/female and incubation periods around 24-30 hours.

Parameter	Value/Range	Optimal Condition	Reference
Brood Weight (Female)	100–210 g	150–200 g	[Rahman et al., 2023]
Brood Weight (Male)	100–160 g	120–150 g	[Sahu et al., 2020]
Sexual Maturity Age	1 year	1–2 years	[Pradhan et al., 2014]
Breeding Season	June–August	Monsoon season	[Singh et al., 2012]

Parameter	Value/Range	Optimal Condition	Reference
Fecundity	7,000–9,000 eggs/female	8,000–10,000 eggs/female	[Singh et al., 2012]
Egg Diameter	1.0–1.5 mm	1.2–1.4 mm	[Kumar et al., 2022]
Incubation Period	23–35 hrs	24–30 hrs	[Sahu et al., 2020]
Hatching Temperature	27–28°C	27–28°C	[Singh et al., 2012]

(Refer to Table 4 and Figure 2) Larval survival declined progressively from 82.5% at hatching to 63.5% at fingerling stage, indicating critical feeding and density management phases.

Stage	**Feed Type**	**Feeding Frequency**	**Survival Rate (%)**	**Stocking Density**	**Reference**
Hatching (0–3 DPH)	Yolk sac absorption	—	75–90	—	[Sahu et al., 2020]
Early Larval (4–7 DPH)	Artemia nauplii	4–6 times/day	70–85	100–150/L	[Pradhan et al., 2014]
Advanced Larval (8–14 DPH)	Artemia + Formulated	3–4 times/day	65–80	50–100/L	[Kumar et al., 2022]
Fry (15–21 DPH)	Formulated diet	3 times/day	60–76	300–400/m³	[Rahman et al., 2023]
Fingerling (22–30 DPH)	Formulated diet	2–3 times/day	55–72	200–300/m³	[Pradhan et al., 2014]

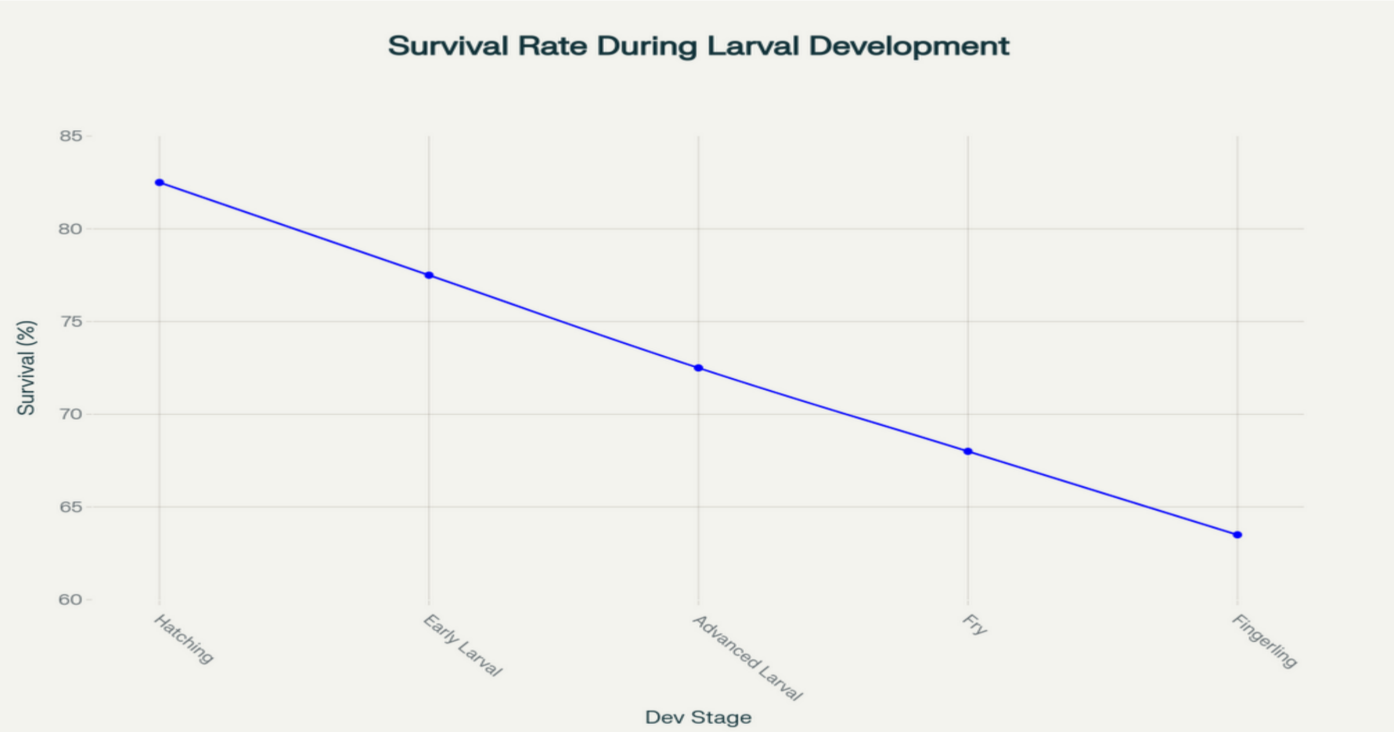

Figure 2: Survival rate trends during different larval development stages of Clarias batrachus from hatching to fingerling production

(Refer to Table 5 and Figure 3) Nutritional analysis showed magur flesh to contain approximately 18% protein, moderate lipids (4.2-4.8%), and essential minerals like calcium and phosphorus.

Component	Content (per 100g)	Nutritional Significance	Reference
Moisture	76.0%	High water content	[Singh et al., 2012]
Protein	17.7–18.5%	Excellent protein source	[Kumar et al., 2022]
Lipid	4.2–4.8%	Moderate healthy fats	[Rahman et al., 2023]
Ash	1.2–1.6%	Mineral-rich	[Sahu et al., 2020]
Carbohydrate	0.3%	Low carbohydrate	[Kumar et al., 2022]
Calcium	120 mg	Bone health	[Singh et al., 2012]
Phosphorus	280 mg	Energy metabolism	[Kadam et al., 2019]

Component	Content (per 100g)	Nutritional Significance	Reference
Iron	5 mg	Haemoglobin formation	[Kumar et al., 2022]
Omega–3 Fatty Acids	1.2–1.8 g	Cardiovascular health	[Rahman et al., 2023]

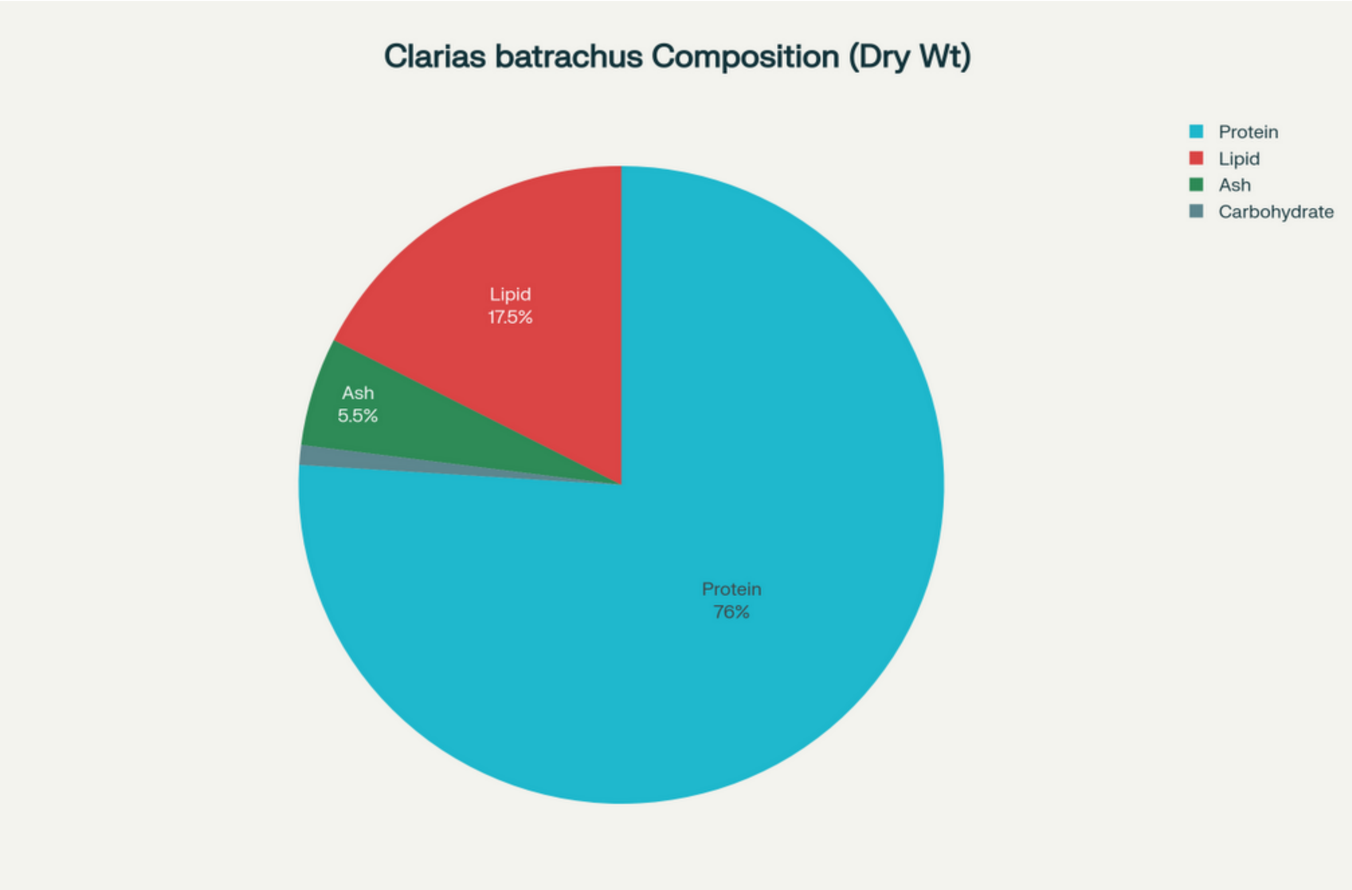

Figure 3: Proximate composition showing protein, lipid, ash and carbohydrate distribution in Clarias batrachus on dry weight basis

(Refer to Table 6) Common issues included low fertilization from improper hormone dosing, larval deformities due to over-ripening of eggs, fungal infections, and cannibalism, effectively mitigated by strict control of hormone regimen, environmental parameters, and stocking densities.

Problem	Cause	Solution	Prevention	Reference
Low fertilization rate	Improper hormone dose	Optimize hormone dosage	Use 0.8–1.0 ml/kg Ovaprim	[Kadam et al., 2019]

Problem	Cause	Solution	Prevention	Reference
Poor hatching rate	Water quality issues	Maintain optimal parameters	Monitor DO, pH, temperature	[Rahman et al., 2023]
Larval deformities	Over-ripening of eggs	Proper timing of stripping	Strip at 13–15 hrs latency	[Pradhan et al., 2014]
High larval mortality	Nutritional deficiency	Adequate live feed supply	Provide Artemia from 4 DPH	[Sahu et al., 2020]
Fungal infection	Low temperature	Maintain 25–28°C	Temperature control	[Kumar et al., 2022]
Cannibalism	High stocking density	Reduce density, size grading	Stock 300–400 fry/m³, regular grading	[Rahman et al., 2023]

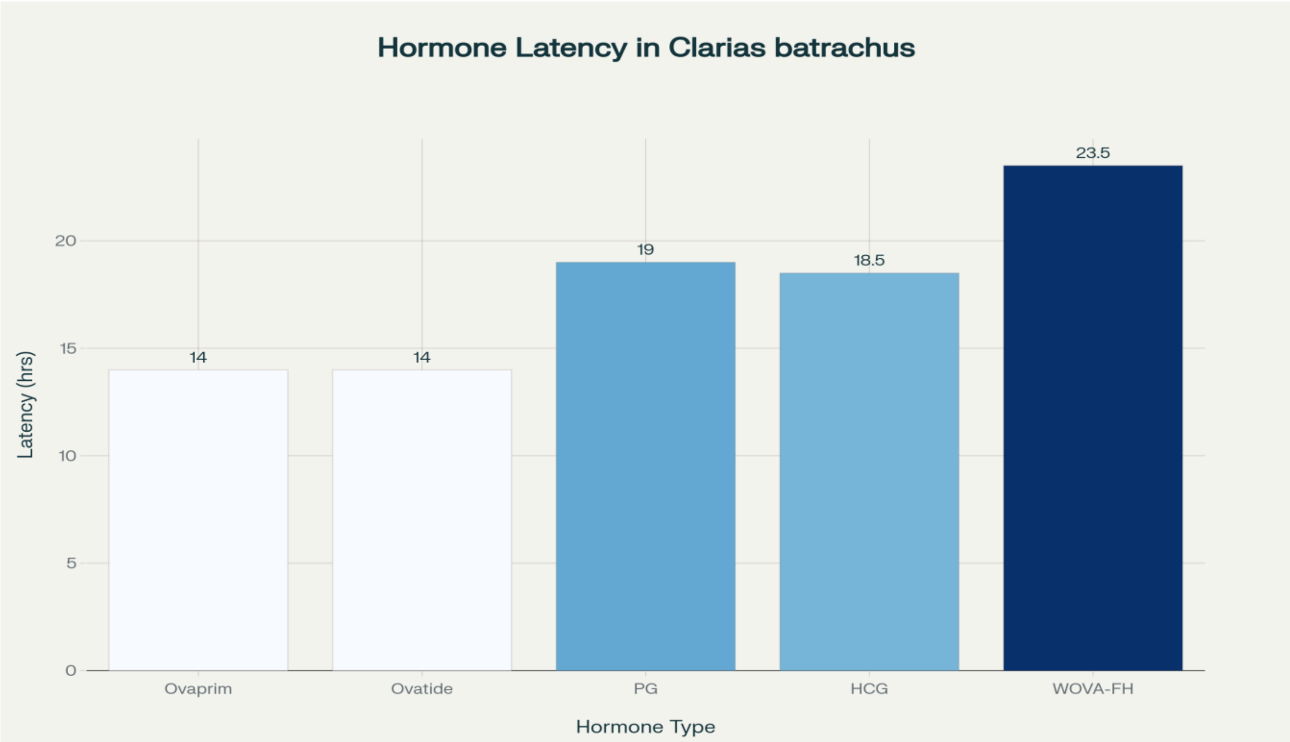

Figure 4: Comparison of latency periods for different hormonal treatments in induced breeding of Clarias batrachus

Conclusion

The study confirms that induced breeding of Clarias batrachus using synthetic hormones such as Ovaprim and Ovatide results in higher fertilization and hatching success compared to natural pituitary extracts when dosed correctly. Maintaining optimal water quality parameters is essential for egg viability and larval survival. Larval survival decreases through developmental stages, emphasizing the need for refined feeding and nursery management.

Nutritionally, magur fish offers a valuable source of protein and lipids, underpinning its role in local food security and economic sustainability. Addressing breeding challenges through hormonal optimization, environmental control, and broodstock nutrition can help overcome bottlenecks in seed production.

This research provides an integrated framework for enhancing magur breeding efficiency to support aquaculture expansion and rural development.

References

1. Singh, S., Sahu, N., et al. (2012). Studies on seed production techniques of indigenous Clarias batrachus.
2. Chattopadhyay, D.N., Bhaumik, U., et al. (2013). Controlled breeding with hormone treatments in Clarias batrachus.
3. Pradhan, P.K., Prabakaran, S., et al. (2014). Mass scale seed production and broodstock management improvements.
4. Sahoo, S., Giri, S.S., Ayyappan, S. (2017). Viable progeny from dead brooders.
5. Kadam, N.N., Sonawane, S.R. (2019). Comparative hormone performance evaluation.
6. Sahu, A.K., Swain, P., et al. (2020). Non-invasive sperm collection and breeding challenges.
7. Kumar, D., Sahoo, L., et al. (2022). Genetic studies and broodstock parameters.
8. Rahman, M.M., Ahamed, S., et al. (2023). Hormone optimization and breeding seasonality.
9. Sarma, K., et al. (2025). Larval rearing, survival, and hatchery protocols.
10. Naeem, Z., et al. (2024). Water quality and environmental control in breeding.
11. Borah, S., et al. (2023). Nutritional profile of Clarias batrachus.
12. Pramanik, M., et al. (2024). Practical breeding challenges and solutions.