



Steroid Hormones in Fish, Caution for Present And Future: A Review

¹Alisha Shahab Khan,² Divya Bhaskar Jadhav, ³Kirti Rupesh More, ⁴Hansika Rai,
⁵Dr. Harsha Padwal Gawande.

¹U.G. Student, Department of Zoology, B.K .Birla Night College, Kalyan, Maharashtra, India

²U.G. Student, Department of Zoology, B.K .Birla Night College, Kalyan, Maharashtra, India

³U.G. Student, Department of Zoology, B.K. Birla Night College, Kalyan, Maharashtra, India

⁴U.G. Student, Department of Zoology, B.K .Birla Night College, Kalyan, Maharashtra, India

⁵Assistant Professor, Department of Zoology, B.K. Birla Night College, Kalyan, Maharashtra, India

ABSTRACT: Growth hormone (GH) in fish affects many physiological processes, including growth, metabolism, reproduction, and behavior. Growth hormone (GH) plays a critical role in growth and development of fish, influencing various physiological processes such as metabolism, somatic growth, and reproductive functions. Growth hormone (GH) is a pleiotropic hormone crucial for regulating a diverse array of physiological processes in fish. Its key effects include stimulating the production of insulin-like growth factors (IGFs), which mediate the anabolic effect of GH. This abstract highlights the multifaceted actions of GH in fish, emphasizing its importance in both fundamental physiology and applied aquaculture. GH impacts the immune response and the adaptation of fish to various stresses. This hormone has significant implications for aquaculture, as a understanding its role can lead to improved fish growth rates, enhanced disease resistance, and better management strategies. GH interacts with reproductive, immune, and behavioral systems, influencing gonadal development, immune function, and potentially even social interactions. This abstract underscores the complexity of GH action in fish and the need for continued research to fully understand its diverse roles and potential application in aquaculture.

KEYWORDS: Growth Hormone in Rohu, Catla, Tilapia, Physiological effect of Growth Hormone, Impact of Growth Hormone, Lack of Growth Hormone in Fish.

I. Introduction

The use of steroid hormones (Estrogen, progesterone, testosterone) in fish farming to promote growth, especially when one sex grows faster than the other, is raising global concerns (Li *et al.*, 2018). It is used to enhance fish growth, weight, and size for greater economic benefit (Hoga *et al.*, 2018). Steroid hormones in fish bind to hormone-receptor complexes in DNA, activating specific genes and increasing protein production (Khalil *et al.*, 2011). Studies have shown that synthetic steroid hormones were commonly used to promote growth in various fish species, with Carp and Tilapia being the most frequently treated (Das *et al.*, 2022; Islam *et al.*, 2015; Zhai *et al.*, 2022).

II. Physiology effect of GH in fish:

The administration of exogenous growth hormone (GH) has been shown to increase appetite, improve feed conversion efficiency, and promote growth. Specifically in salmonids, GH leads to hyperphagia, or increased food intake, which contributes to accelerated growth (Devlin *et al.*, 1994). GH-treated fish consume more food and utilize it more efficiently than control fish (Gill *et al.*, 1985). Exogenous growth hormone (GH) treatment accelerated the specific growth rates of wild rainbow trout by 2.7-fold, while domestic

trout showed only a modest 9% increase (McLean *et al.*, 1997), suggesting genetic background influences the response to GH revolution. Selection for rapid growth is linked to increased activity of endocrine growth regulators (Fleming *et al.*, 2002), and administering exogenous GH may push these fish beyond their physiological limits to manage further GII. Evidence suggest that GH plays in role in the endocrine regulating of reproduction in fish. these finding suggest that GH may influence gonadal growth and sex steroid production during the final stages of reproduction, although further research is needed to clarify its precise role in (McLean & Devlin *et al.*, 2000).

III. IMPACT OF GH IN FISH :

Catla Catla:

This study of focuses on the growth potential of *Catla Catla*, an Indian major carp, in aquaculture. The species in valued for its rapid growth and market potential, with a current market price ranging from Rs. 80 to 140 per kilogram. A key factor in optimizing growth performance is the availability of suitable diets that are efficiently digested and meet the fish's nutritional needs (Mokolensang *et al.*, 2003). Sabapathy and teo (1993) found that major carp exhibit amylolytic activity, meaning they can break down starches. Additionally, (Erfanullah *et al.*, 1995) reported that rohu, a type of carp, are more efficient at utilizing complex polysaccharides (like starch) than simple sugars. Recorded the carbohydrate level and protein-sparing effect in fish (Sen *et al.*, 1978). Highlighted that supplementary feeding can significantly increases the carrying capacity of culture systems, boosting fish reproduction manyfold. It is also an effective method for achieving rapid fish production in ponds (Devaraj *et al.*, 1976).

Rohu:

The Rohu (*Labeo rohita*) i is key species in Indian major carps (IMCs) and playas a role in aquaculture in countries such as Bangladesh, India, Myanmar, Vietnam, Laos, and Nepal, as noted by (F. The rohu (*Labeo rohita*) is a commercially important tropical freshwater species, highly valued by fish culturists for its strong market demand, suitability for polyculture, and high consumer acceptance, as highlighted by (Shahjahan *et al.*, 2020). The optimal temperature for this species ranges from 28-33°C. Recent studies show that high acclimation temperature can negatively effect growth, Hemato-biochemical indexes, and cause cellular and nuclear abnormalities (Ashaf-Ud-Doulah *et al.*, 2019, 2020). the use growth in the *Labeo rohita* (Rohu) aquaculture boost growth rates, improves feed conversion, and increases muscle mass, leading to faster production and higher economics gains. However, it can also cause early maturation, potential health risks, and hormone residue concerns.

Tilapia:

Tilapia is key species in Cuba's freshwater fish production, accounting for over 70% of the total production (Guillen *et al.*, 1999). This high level of production has driven considerable interest in enhancing tilapia growth rates through genetic modification, making GH-transgenesis is a critical area of research for improving productivity and efficiency in tilapia farming. Ectopic, low-level expression of the transgene (GH) tilapia was observed in various tissues, including the brain, liver, muscle, and gonads of F1 & F2 transgenic fish (Martinez *et al.*, 1996, Hernandez *et al.*, 1997). This suggest that controlled, low level expression of the transgene may be key to enhancing growth rates without negative side effects, as observed in these specific lines (Hernandez *et al.*, 1997). Change in physiological processes in transgenic tilapia, as result of genetic modification, led to alteration in their behavior (Guillen *et al.*, 1999). Respirometry studies showed that the expression of the GH transgene in tilapia increased their metabolic load, maintaining overall energy balance (McKenzie *et al.*, 2003). This suggest that while genetic modification can enhance metabolic activity, tilapia have mechanisms to adapt to the change.

IV. Lack of Growth hormone:

Reproduction:

Fish reproduction varies, but most species lay large numbers of small eggs, which are fertilized externally and scattered outside the body. Pelagic fish egg float in open water, while shore and freshwater fish often lay eggs on the bottom or among plants, some with adhesive properties. Most fish reproduce sexually with separate sexes, and to prevent self-fertilization, they produce sperm and eggs at different times. Fish typically produce many gametes, and fertilization usually occurs externally in oviparous species, where egg are laid and embryos outside the mother's body. males produce sperms, typically a milky substance called milt, in testes, with sperms ducts leading to a urogenital opening is bony fish or a cloaca in sharks, rays, and cyclostomes.

Length & Weight:

The log transforming formula of (Le Cren *et al.*,1951) is commonly used to establish length-weight relationship (LWRs) for fish (Le Cren *et al.*,1951).To account for periodic variations affecting the b parameter (Zarger *et al.*, 2012), fish were grouped based on the season they were caught: warm period (spring and summer) and cold period (fall and winter).The formula mentioned suggest that the growth pattern (b) in the mathematical model to real fish samples, the value of b might differ from the ideal value of 3, which represents isometric growth (Ricker and carter *et al.*, 1958) where the fish grow proportionally in all dimensions. The deviation occurs due to various factors such as environmental condition (e.g., temperature, food availability, habitat quality) or the individual condition of the fish (e.g., health, age, or genetic factors). These factors can cause fish to grow in ways that are not perfectly proportional, thus affecting the value of b in the growth model.

Length:

Fish length refer to the measurement from the tip of a fish's snout (or mouth) to the end of its tail (or caudal fin). It is commonly used in fisheries biology, aquatic research, and to assess fish health or population characteristics. Length can be an indicator of a fish's age, growth, and reproductive status. fish length is often categorized as total length or fork length, depending on the measurement point used. Standard length (SL) refer to the measurement of a fish from the tip of it's snout to the end of it's last vertebra or hypural plate, excluding the tail fin. Total length (TL) measures a fish from the snout to the tip on the longest caudal fin lobe, including the tail fin. It is commonly used for species such as hagfish and sharks. Fork length (FL) is the measurement from the snout to the end of the middle caudal fin rays, commonly used for fish species with forked tails.

Maturity:

The Gonadosomatic index (GSI) in fish increases with maturation, peaking during the breeding season and declining after spawning. The GSI is highest in June and lowest in November, aligning with the fish's breeding period from June to July. Studies show two spawning events per year, with the first in mid-September to October and the second in march after a dormant phase during winter. Seasons change in the ovaries of Teleosts have been studied through histology, ova diameter, and GSI measurement to understand their reproductive cycles(Ashaf-Ud-Doula *et al.*,2019).

V. Conclusion

Growth hormone is crucial for fish growth and development, stimulating tissue and organ growth through processes like protein synthesis, cell division, and metabolism. It work in tandem with hormone like insulin-like growth factors (IGFs) for proper development. Environmental factors such as temperature, food availability, and water quality influence its secretion and in fish is vital for improving aquaculture practices, optimizing growth rates, and maintaining fish health. Growth hormone (GH) is essential for regulating somatic growth and a variety of physiological processes in fish, including energy metabolism, reproduction, feeding behavior, osmoregulation, and immune function. It acts as key regulator of fish development and wellbeing, with its release and activity closely controlled by both environmental and internal factors. hormones play a key role in fish reproduction, growth, and metabolism. Hormone are crucial in regulating fish metabolism, growth, reproduction, and behavior. In aquaculture, hormone can be used to manipulate fish reproduction, enhancing breeding and production efficiency. By influencing hormonal cycle, aquaculture practices can be optimize fish growth rates, reproductive timing, and overall health, supporting better management and yields in fish farming. Hormone are essential for fish reproduction, growth, and metabolism. They regulate the gastrointestinal tract and assist in fish adaptation to salinity changes.

VI. Reference

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