



# **UNIT-I**

# **FUNDAMENTALS OF FISH NUTRITION AND FISH GROWTH**

# Introduction

- ▶ **Global aquaculture production increases significantly**
- ▶ Increase competition- primary resources, land and water and equally environmental concerns
- ▶ Aquaculture can no longer be considered as an industry because of some traditional practices were based on optimum utilization of resources
- ▶ Fish production - Aquaculture
  - capture fisheries

Aquaculture - Horizontal ( Limited due to space) and vertical expansion(Intensive based or feed based aquaculture)

- ▶ Feed and feeding are the crucial element of the aquatic element
- ▶ Feed cost considered to be the highest cost in aquaculture (30-60%), depend upon the intensity of operation
- ▶ The cost reduction either through
  - diet development or improve husbandry
  - study about nutrient requirement of culture species

▶ For fish feed formation using more than one ingredient because one single ingredient can not full fill the requirement of nutrient

▶ required nutrient for fish - for the growth

health maintenance

Immunity and quality production

▶ Nutrient for fish feed- Carbohydrate, Protein, Lipids, Minerals and Vitamins

▶ Requirements of Nutrients depends on the various factors-

Species, Size of the species, Age of the species Metabolic state of the species, Environmental condition

Other than ingredient use for feed formation- Binder, Growth promoter, pigments, feed stimulants, antioxidants, enzymes, preservative are used

- ▶ Fish nutrient requirement is most important factor for fish production and economic production of fish because production cost around 30-60%
- ▶ Species diet most important - because they satisfied requirement, safe and high quality fish production
- ▶ Fish growth is affected by either less intake and of feed or underutilization of feed
- ▶ Nutritionally balanced diets required research, quality control and biological evaluation of feed
- ▶ Need to be developed suitable feed based on locally available Ingredients

**Before feed formation very essential to know about-**

- Requirement of nutrient of species
- Ingredient proximate composition
- Digestibility of ingredient
- Anti-nutrient factor present in ingredient
- Availability and not compete with human food

# Fish Growth

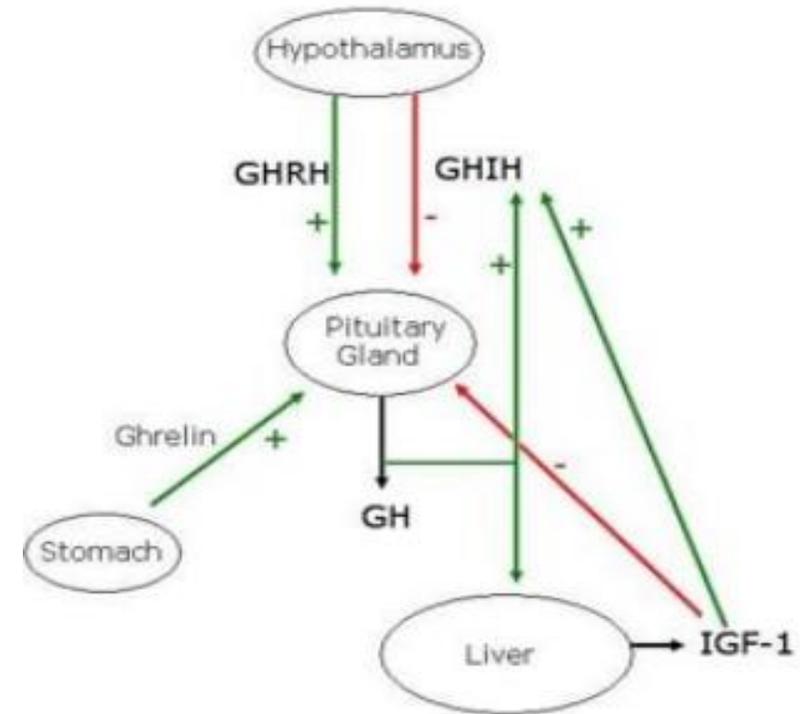
- ▶ Growth is the quantitative aspect of development, and it is one of the main ways in which an individual or a population responds to changes in the food supply and food intake.
- ▶ Growth may vary with the food supply for several reasons, such as change in the food eaten, amount of food.
- ▶ Growth is an increase in muscle (smooth and striated), skeletal and organ tissue. Growth may be defined as the change over time of the body mass (body weight) of a fish.
- ▶ Growth can be either somatic or reproductive. Somatic growth entails an increase in the size of the body, while reproductive growth entails an increase in the size of the reproductive organs or the gonads.

# Nutrient requirement and growth in fish

- ▶ **Growth curve** is obtained when either length or weight of a fish is plotted against time periods. The curve obtained is sigmoid or S-shaped
- ▶ Fish growth - Involve muscle growth
  - S Shape growth
  - fish growth never stop growing but growth is slower at older age
- ▶ Growth of fish depend on culture practice, environmental condition and nutrient and nutrient sources
- ▶ Nutrient requirement is depend on the metabolic rate and age/species
- ▶ Major nutrient- protein Lipid and Carbohydrate
- ▶ Micronutrient- Minerals and Vitamins

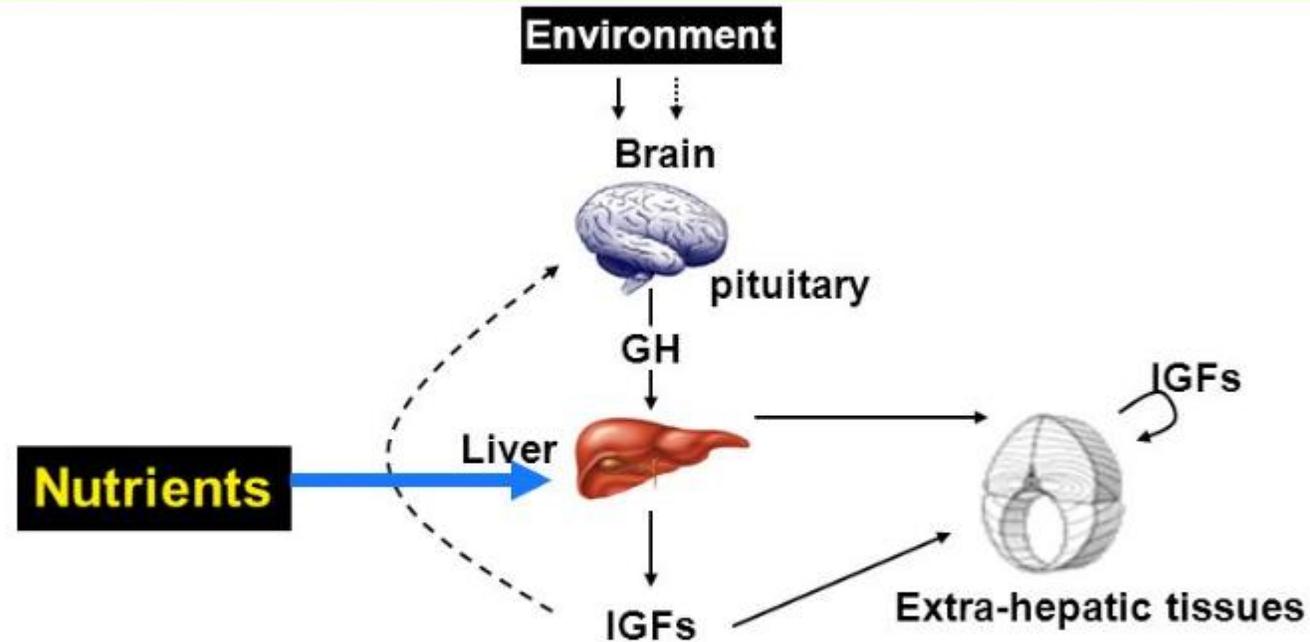
- ▶ Fish growth by two mechanism - Hypertrophy( Increase cell size) and hyperplasia (Increase Number of cell)
- ▶ Growth regulated by -Nutrient, Hormonal and environmental

- ▶ GHRH-Growth hormone releasing hormone
- ▶ GHIH-Growth hormone inhibiting hormone
- ▶ GH-Growth hormone
- ▶ IGF-I-Insulin Like growth factor I



**IGF-I -Cell differentiation and proliferation**

## The hepatic expression IGF-1 is under the dual regulation of nutrients and GH



- The nutritional regulation of the GH-IGF-I axis is an interface between nutrients and hormones acting in concert to control animal growth.
- This interface is conserved throughout vertebrate evolution.

# GROWTH EVALUATION

- ▶ The growth can be estimated by taking initial and the final body weight. The different growth parameters are as:

## Specific growth rate (SGR)

The Specific Growth Rate is the percentage increase in size per day

$$\text{SGR} = \frac{\text{Log}_e \text{ Final weight} - \text{Log}_e \text{ Initial weight}}{\text{Number of days}} \times 100$$

# Feed conversion ratio (FCR)

The Feed Conversion Ratio is the ratio of feed given in gram to fish or animal and body weight gain in gram

$$\text{FCR} = \frac{\text{Feed given (Dry Weight)}}{\text{Body weight gain (Wet Weight)}}$$

# Feed efficiency ratio (FER)

Feed efficiency ratio is the ratio of body weight gain in gram to the feed given in gram

$$\text{FER} = \frac{\text{Body weight gain (Wet Weight)}}{\text{Feed given (Dry Weight)}}$$

# Protein efficiency ratio (PER)

- ▶ Protein efficiency ratio is the ratio of body weight gain in gram to the protein feed in gram

Protein efficiency ratio was calculated by the following formula

$$\text{PER} = \frac{\text{Body weight gain (Wet Weight)}}{\text{Protein Fed}}$$

# Percentage Weight (% WG)

$$\% \text{ WG} = \frac{\text{Final weight(gm)} - \text{Initial weight(gm)}}{\text{Initial weight (gm)}} \times 100$$