

Nutritional deficiency Diseases in fishes

Introduction

- Nutritional disease has been defined as those which can be attributed to deficiency, excess or improper balance of components present in a fish diet.
- If food contain all necessary components in proper balance, a nutritional disease is possible.

Types of Nutritional Diseases

- It falls under four categories, namely:
 - Those arising from **under nutrition** or dietary deficiencies or imbalances in major components of food (Macro nutrients – protein, CHO, fat; Micro nutrients – Thyroid tumour, Nutritional gill disease, vitamin A imbalance, Nutritional anemia)
 - Those arising from over nutrition (amino acid toxicity, oxidation of unsaturated fatty acids, fatty acid toxicity, dietary vitamin toxicity and mineral toxicity)

- Those arising from toxic effect of the diet (mycotoxins, toxic algae, anti-nutritional factors effect, anthropogenic chemical disease)

Macronutrients – Protein

Amino Acid	Deficiency Symptoms
Methionine	Cataract
Arginine	Vertebral deformity
Threonine	Vertebral deformity
Tryptophan	Vertebral deformity, fin erosion, kidney stones
Valine	Vertebral deformity, fin erosion, kidney stones
Isoleucine	Vertebral deformity, Increased mortality
Leucine	Vertebral deformity, Increased mortality
Phenylalanine	Vertebral deformity, Increased mortality
Histidine	Vertebral deformity
Lysine	Dorsal fin erosion, increased mortality

Macronutrients - CHO

- Depress the digestion, enlarged livers, Hepatic degenerative changes and glycogen deposition.

Macronutrients – Fat

- Lipoid Hepatic Degenerative Disease: First, liver taken up a yellow brown coloration. Secondly, anemia follows with gill looking pallor. This is mainly because of over feeding.

Micronutrients

- **Thyroid tumor**

- ❖ Caused due to iodine deficiency

Sign and symptoms: abnormal thyroid follicles

Species affected: Salmonids

Remedial: Addition of iodine to fish food

- **Nutritional gill disease**

- ❖ Caused due to Pantothenic acid deficiency

Sign and symptoms: Respiratory difficulties in gills

Species affected: Salmonids

Remedial: Addition of pantothenic acid to fish food

- Vitamin A imbalance : Under growth, blindness, hemorrhage at fin base, keratomalacia
- Nutritional Anemia: Caused by folic acid deficiency

Species affected: Channel catfish

Anemia is characterized mainly by depressed values of erythrocytes and haemoglobin

- **Amino acid Toxicity:** Amino acid excesses also have been known to produce toxic effects. Dietary excesses of leucine at 13.4 % of the diet of rainbow trout resulted in vertebral deformities and scale loss.
- **Oxidation of Unsaturated Fatty acids:** Oxidation of unsaturated fatty acids of diets is disorders due to the presence of auto-oxidation products such as peroxides, hydroperoxides, aldehydes and ketones.

- These free radicals react with other dietary ingredients such as vitamins, proteins and lipids resulting in disorders associated with vitamin, protein (or) lipid deficiencies.
- Oxidative rancidity of oils in feedstuff may manifest into pathological changes in aquatic animals feed on such diets.
- These signs include haemorrhages on skin and fin bases, exophthalmia, loss of appetite, depigmentation or change of body colour, fatty livers, anaemia, muscle damage
- Oxidation of fats can be prevented by using antioxidants such as BHT, BHA and Ethoxyquin

- **Fatty Acid Toxicity:** Due to cyclopropenoic acid (cotton seed oils-fatty acids) has been shown to reduce growth and act as a synergist to carcinogenic effects of aflatoxins (toxins produced by fungus growing on stored food or in food ingredients).
- **Vitamin toxicity:** Dietary vitamin toxicity of fat soluble vitamins is contrastingly more pronounced in fish than of water soluble vitamins.

- Accumulation of vitamins/fat in excess of requirements, leads to hyper-vitaminosis. Possible signs of hypervitaminosis are reduced growths, drop in haematocrit values, fin necrosis, dark colorations, lethargy, reduced RBC count etc.
- **Mineral toxicity:** Due to dietary excesses have also been noticed in intensive culture conditions, possible cause being the use of unconventional sources of feed ingredients.

- Poultry waste of arsenic, pulp waste for leads, fish meal for mercury, cadmium etc. have been the known sources of excesses.
- Dietary excesses of minerals produce signs of reduced growth, kidney stones, vertebral deforming, hyper activity, black tail.
- **Black gill disease:** causative agents: chemical contaminants such as Cd, Cu, Zn, K, ascorbic acid
- Species Affected: *Penaeus monodon*
- Gross signs: Gill shows reddish brownish to black discoloration, loss of appetite, mortality
- Preventive measure: avoids over feeding

- **Blue disease:** Causative agents: low levels of carotenoids (astaxanthin)
Species affected: *Panaeus monodon*
Gross signs: Sky blue colour, lethargic, soft shell may occur
Preventive measure: addition of carotenoids
- **Red Disease:** Causative agents: presence of aflatoxins in feeds, rancid feeds
Species affected: *Panaeus monodon*
Gross signs: sudden drop in feed consumption, body weakness, poor growth, reddish colour of faecal matter
Preventive measure: use recent manufactured feeds

- **Sekoke disease:** Incorporation of significant levels of silkworm pupae in the diet

Symptoms: Bilateral cataract, degenerative changes in extrinsic eye muscle, retina

- Anti-nutritional factors effect disease:

Cotton seeds- 2 toxic components

1. Gossypol causes sudden anorexia and deposition of sudanophilic globules within liver and kidney
2. Deposition of Cyclopropenoid fatty acids within the kernel.

- **Anthropogenic chemical disease:** Residues of substances such as organochlorines or organophosphates-occasionally/accidentally over dosing or dietary contamination can result in acute toxic effects. In such condition, deaths out are usually rapid.