

# Nutritional Disease in Aquatic Animal

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# Nutritional Disease in Aquatic Animal

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- Nutritional pathology / nutritional “diseases” is the studied areas of finfish and crustacean pathology
- Dietary nutritional disorders : diet-related imbalances due to “under-” or “over-” nutrition.



# Causes of nutritional disorders

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Under intensive culture condition, nutritional disorders may arise from a variety of causes, including:

- Deficiencies and imbalances of nutrients
  - Poor feed formulation,
  - Poor feed processing : excessive heat treatment
  - Poor feed stability
  - Poor/prolonged feed storage : lipid oxidation or spoilage



# Causes of nutritional disorders

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- Anti-nutrients and contaminants, including
  - Toxic polyamines and amino acids : biogenicamine
  - Oxidized polyunsaturated fatty acids
  - Heavy metal contaminants: Lead, Cd,
  - Anti-vitamin factors,
  - Specific enzyme inhibitors: trypsin inhibitor

# Causes of nutritional disorders

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- Anti-nutrients and contaminants, including
  - Toxic glycosides,
  - Toxic phenols,
  - Food allergens
  - Microbial toxins: mycotoxin
  - Specific synthetic contaminants : pesticide residues and organochlorine compounds
  - Residues arising from ingredient/feed processing

# Common deficiency signs resulting from nutritional disorders in shrimp

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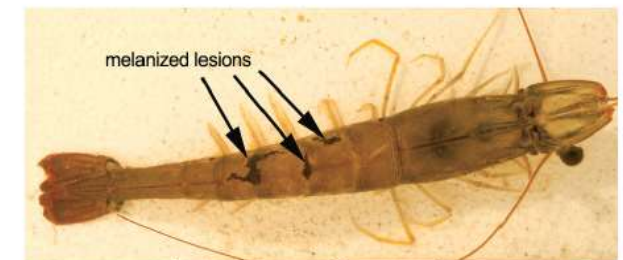
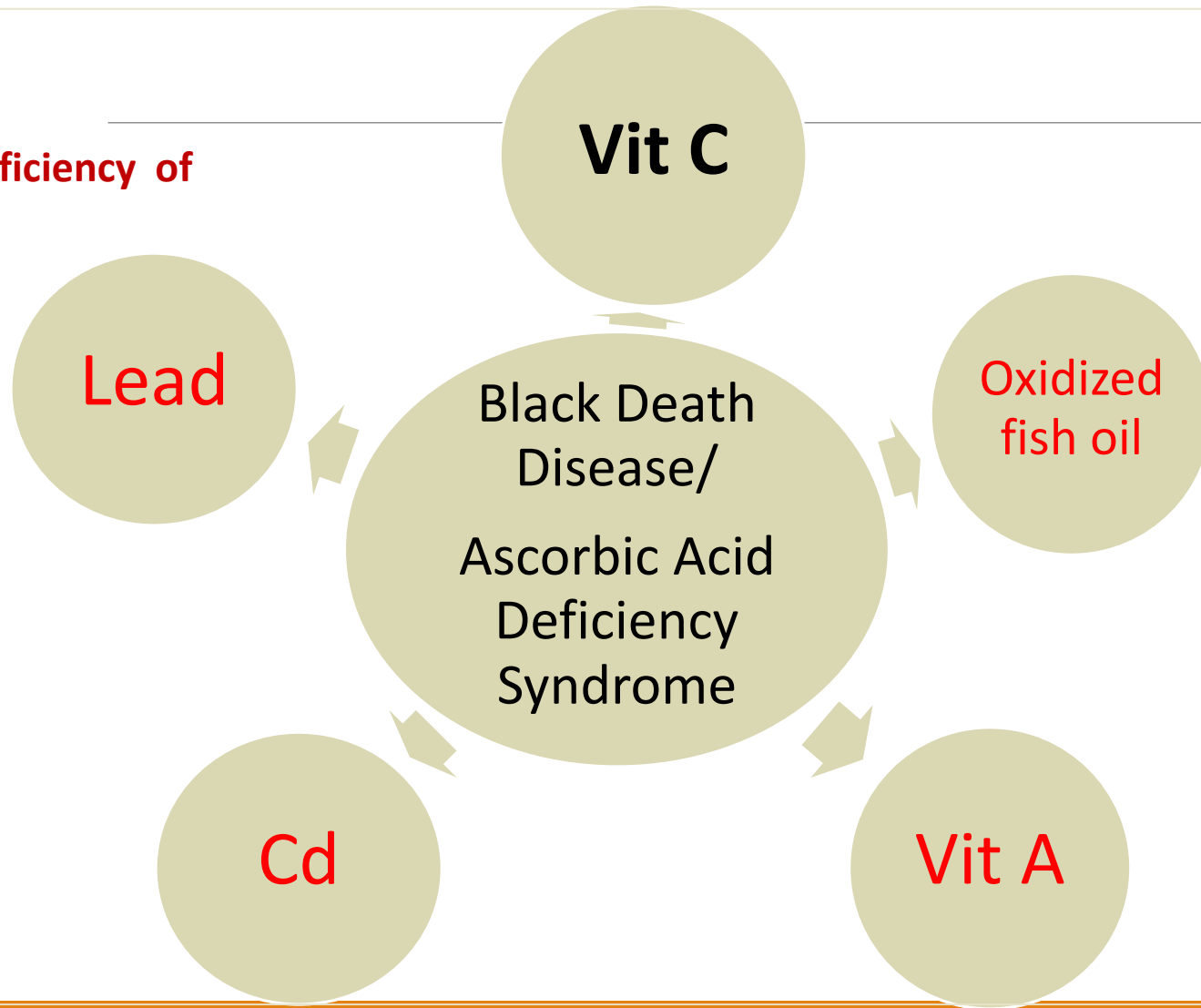
Nutritional diseases reported for penaeid shrimp include

- Ascorbic Acid Deficiency Syndrome (“Black Death Disease”)
- Cramped Muscle Syndrome
- Chronic Soft Shell Syndrome
- Blue Disease (*Penaeus monodon*)



# Nutritional pathology condition in shrimp

Deficiency of



Taura Syndrome

# Nutritional pathology condition in shrimp

Deficiency of

K

Ca, Mg

Cramped  
Muscle  
Syndrome

Vit E

Vit C



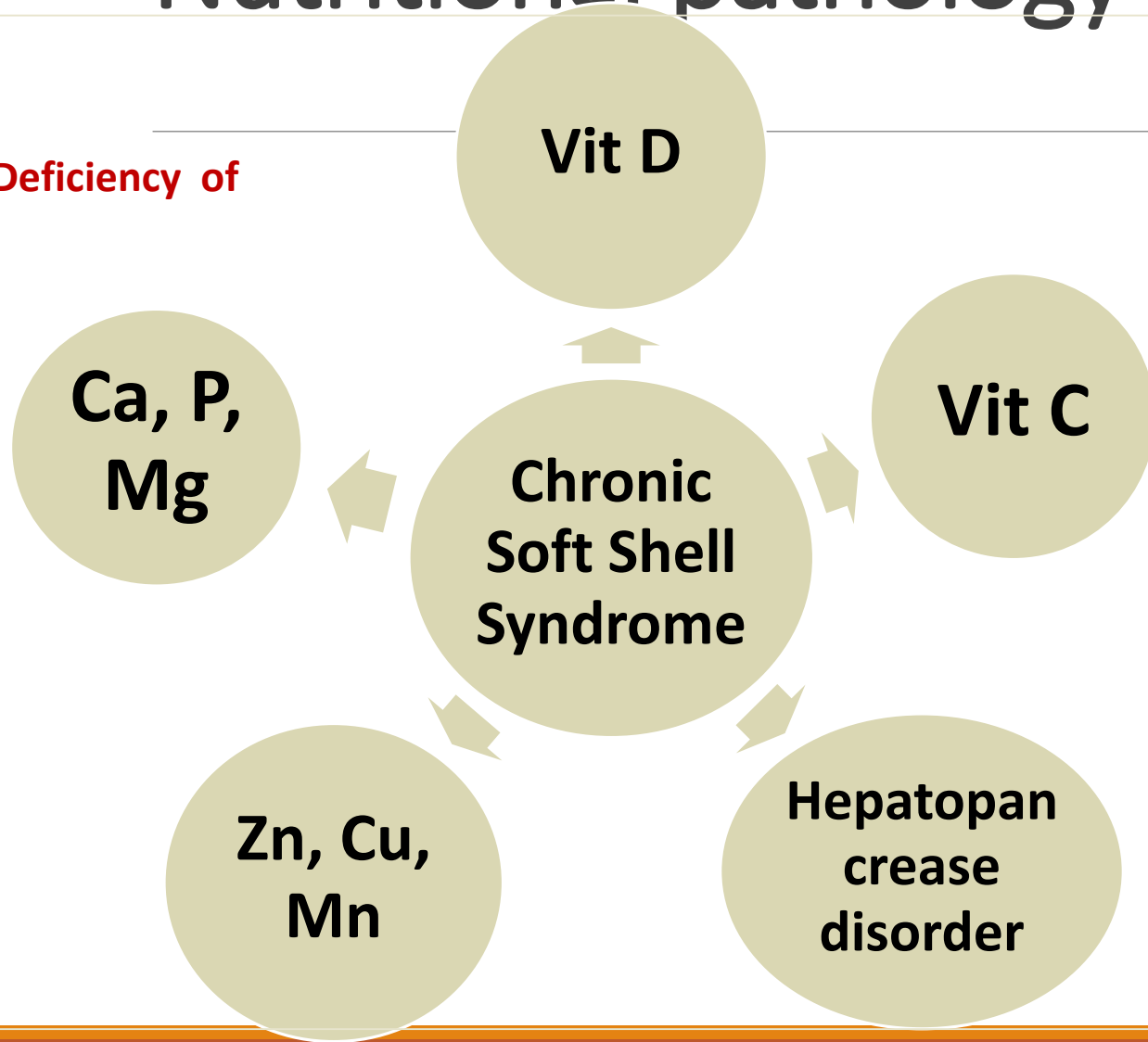
Figure 7 Muscle cramp syndrome





# Nutritional pathology condition in shrimp

Deficiency of



# Nutritional pathology condition in shrimp

Deficiency of

**Vit E**

Toxicity of  
**Mycotoxin**



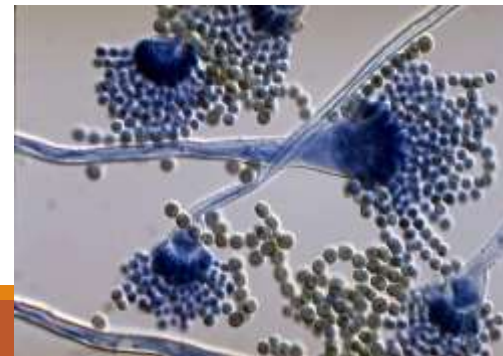
**Zn, Cu,  
Se**

**Blue  
disease**

**Vit C**



**Carote  
noids**



*Sensitivity of various aquaculture species to different mycotoxins.*

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Species	AFB1	FB1	DON
Rainbow trout	+++	++	+++
Shrimp	++	+++	++
Tilapia	++	+	+++
Carp	+	++	+
Catfish	+	+	N/A

**Fumonisin B<sub>1</sub> (FB<sub>1</sub>)**

# Nutritional pathology condition

Deficiency of

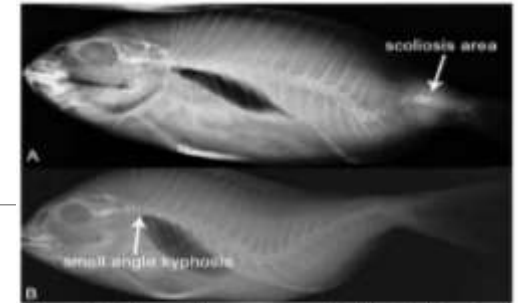
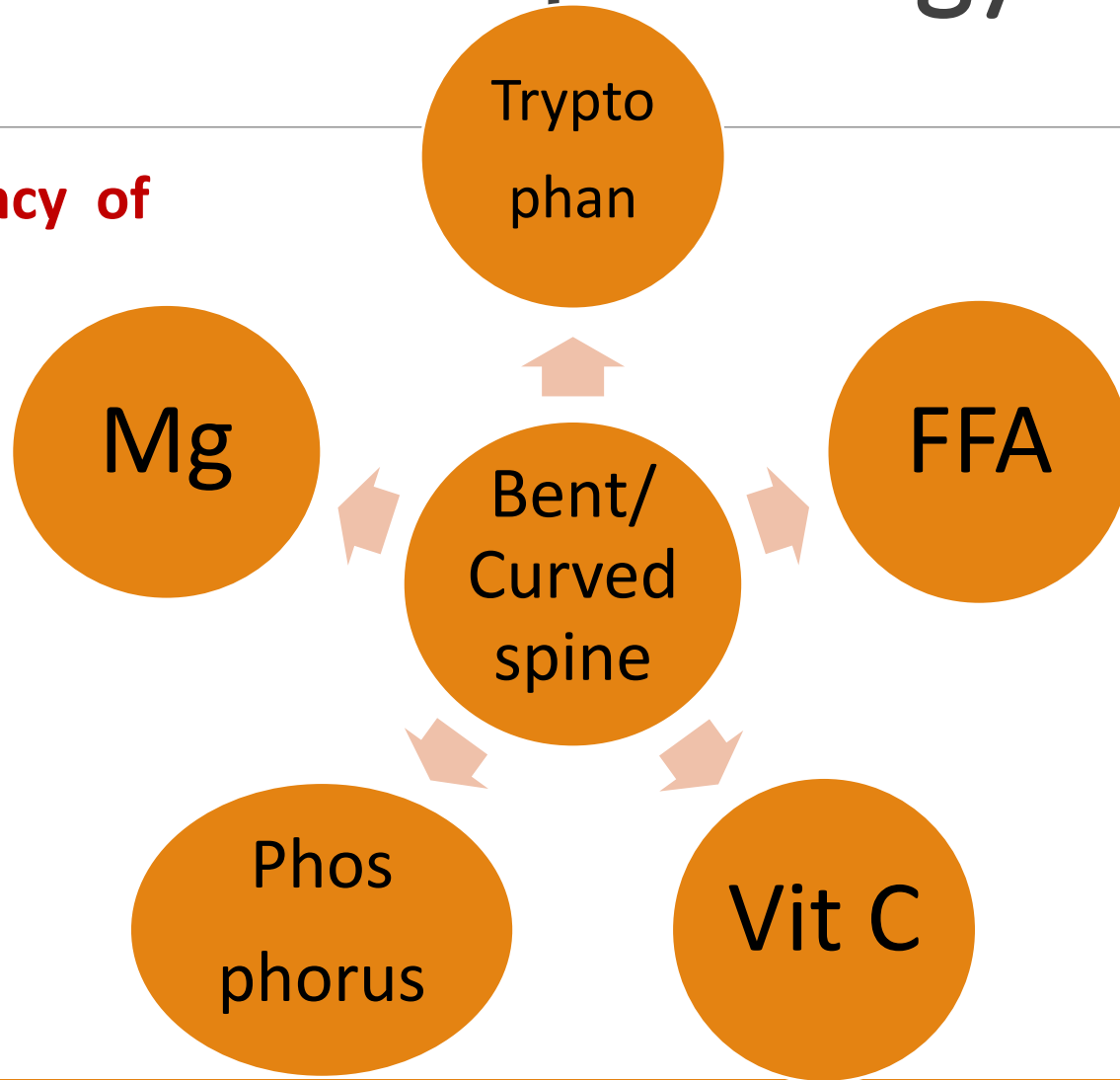
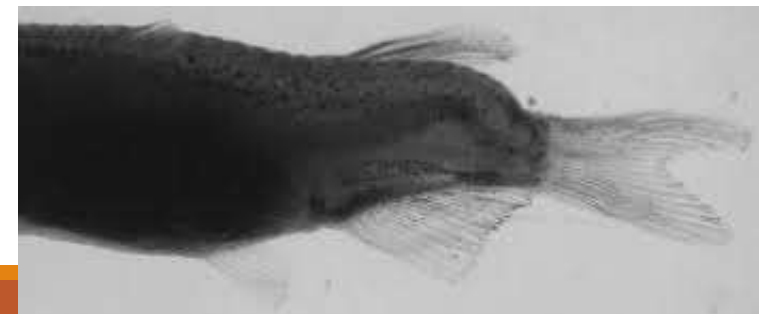
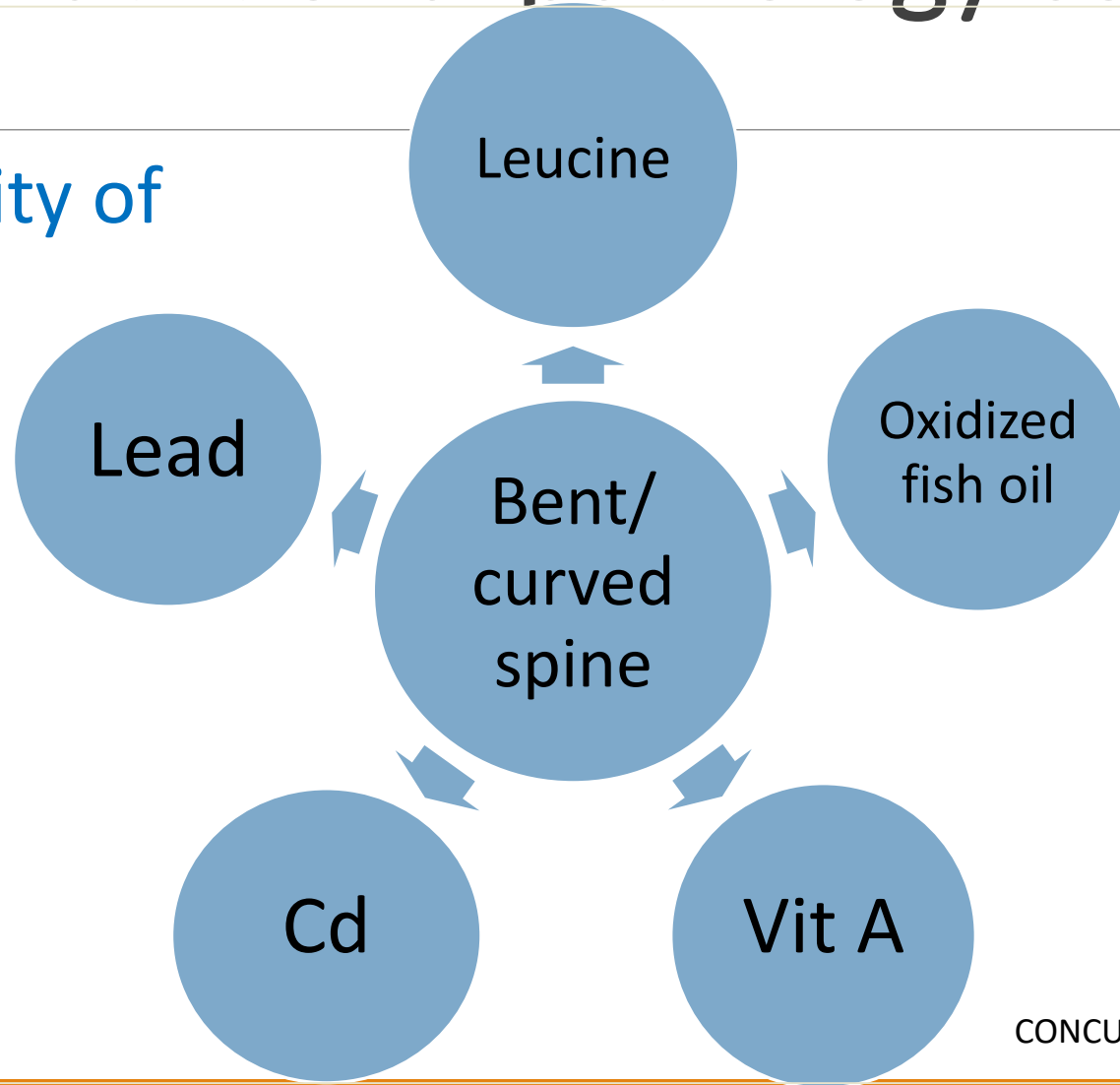


Figure 2: A. X-ray of *Sparus aurata* with skeletal deformity of scoliosis. B. *Sparus aurata* with kyphosis. In both cases lordosis is also present indicated that fishes can have more than one vertebral deformity (Berillis unpublished).



# Nutritional pathology condition

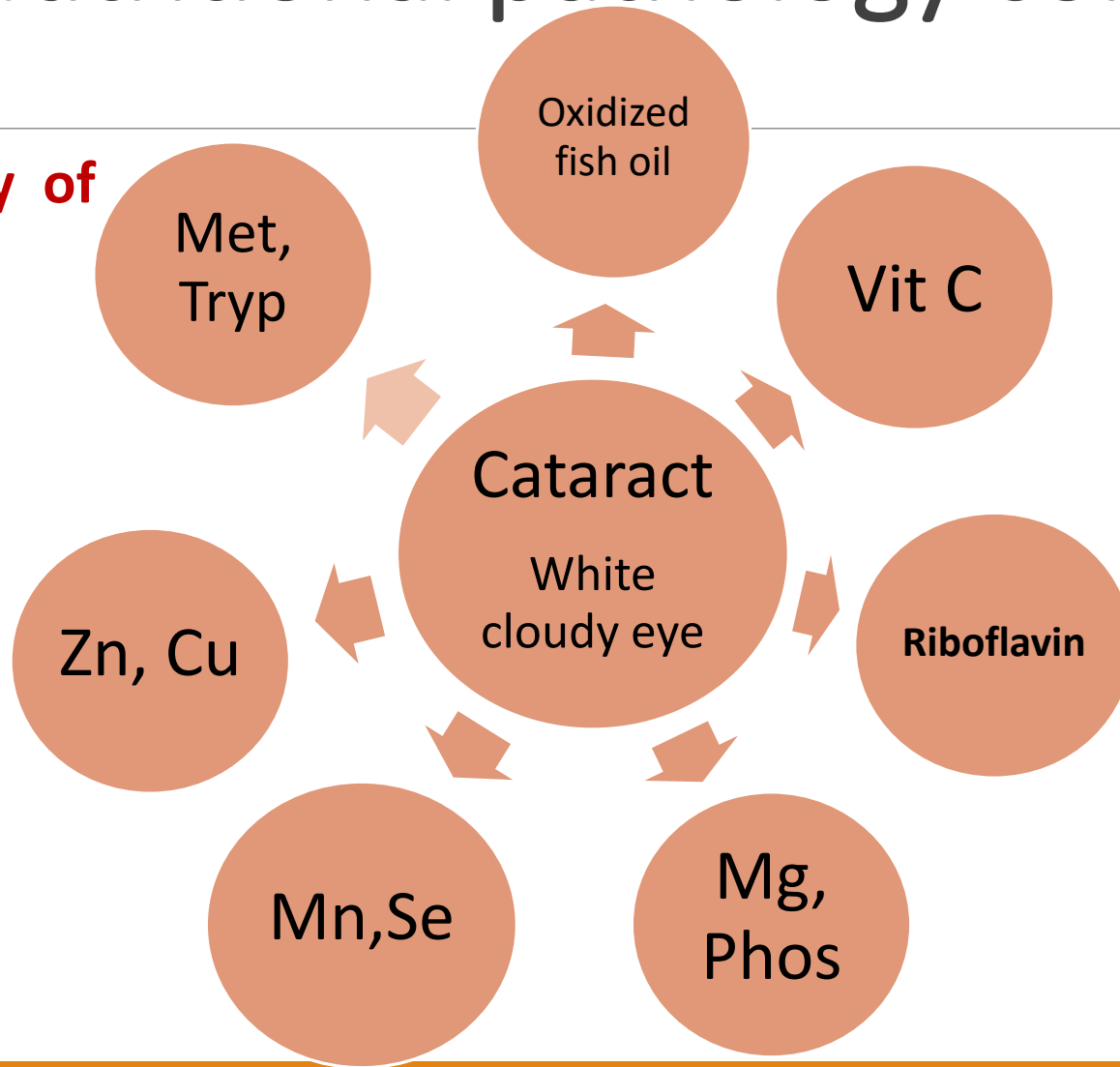
Toxicity of



CONCURRENT INFECTIONS (PARASITISM AND BACTERIAL DISEASE) in TILAPIA

# Nutritional pathology condition

Deficiency of

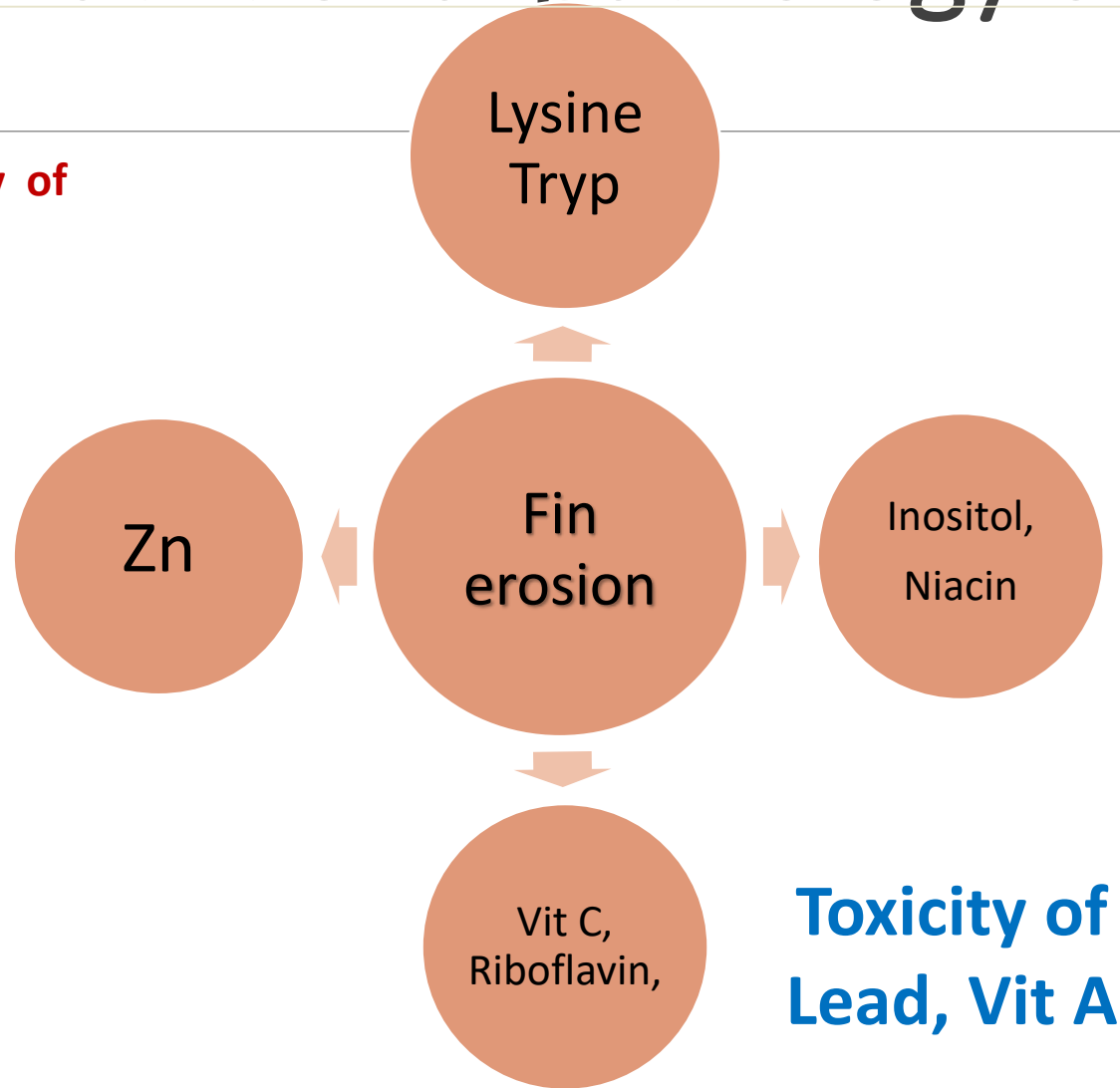


**Toxicity of  
Choline, Vit A**



# Nutritional pathology condition

Deficiency of



**Toxicity of  
Lead, Vit A**



A, level 0



B, level 1



C, level 2



A, level 0



B, level 1



C, level 2



D, level 3



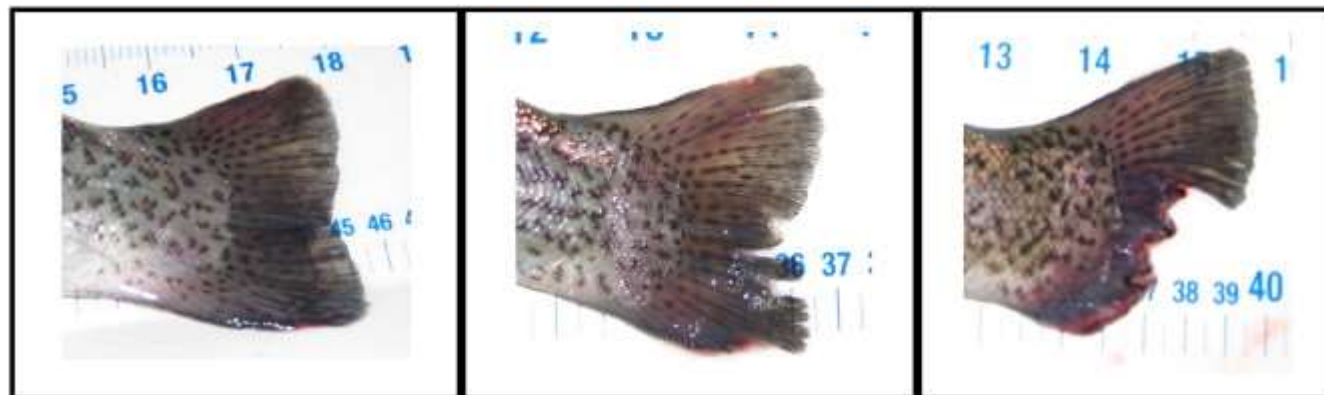
E, level 4



D, level 3



E, level 4





# Nutritional pathology condition

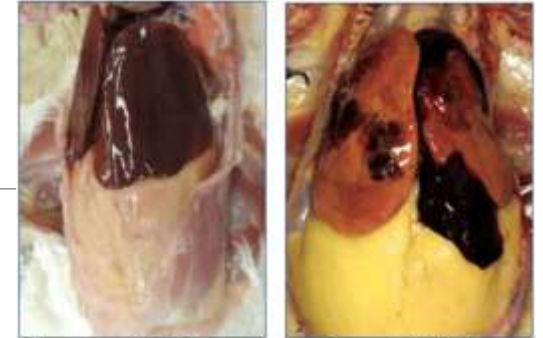
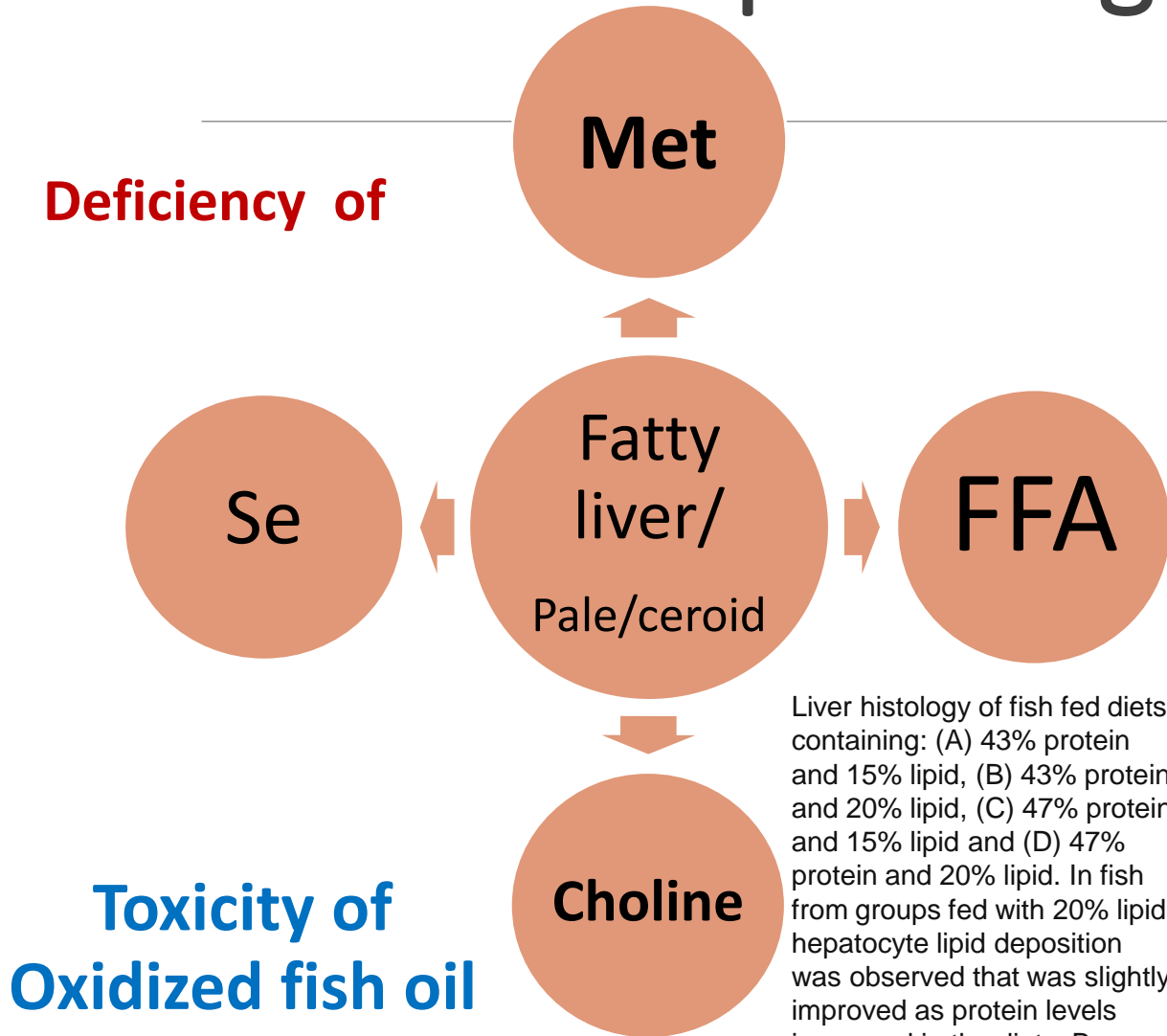
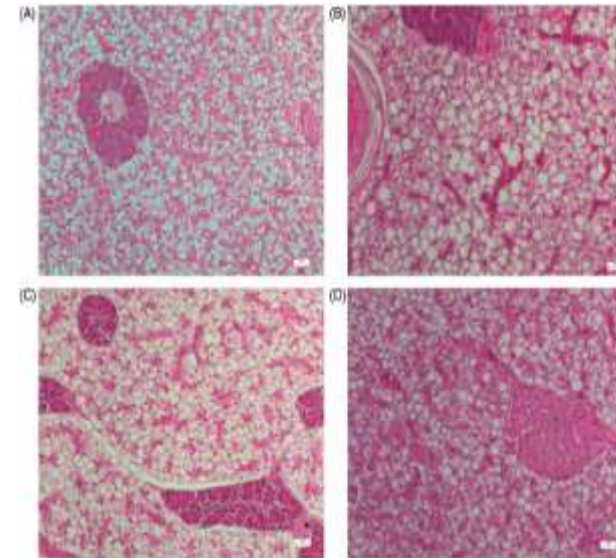


Figure 1a (left): Normal liver. Figure 1b (right): Fatty liver hemorrhagic syndrome. Large blood clots arising from the liver. Note the excessive abdominal fat.

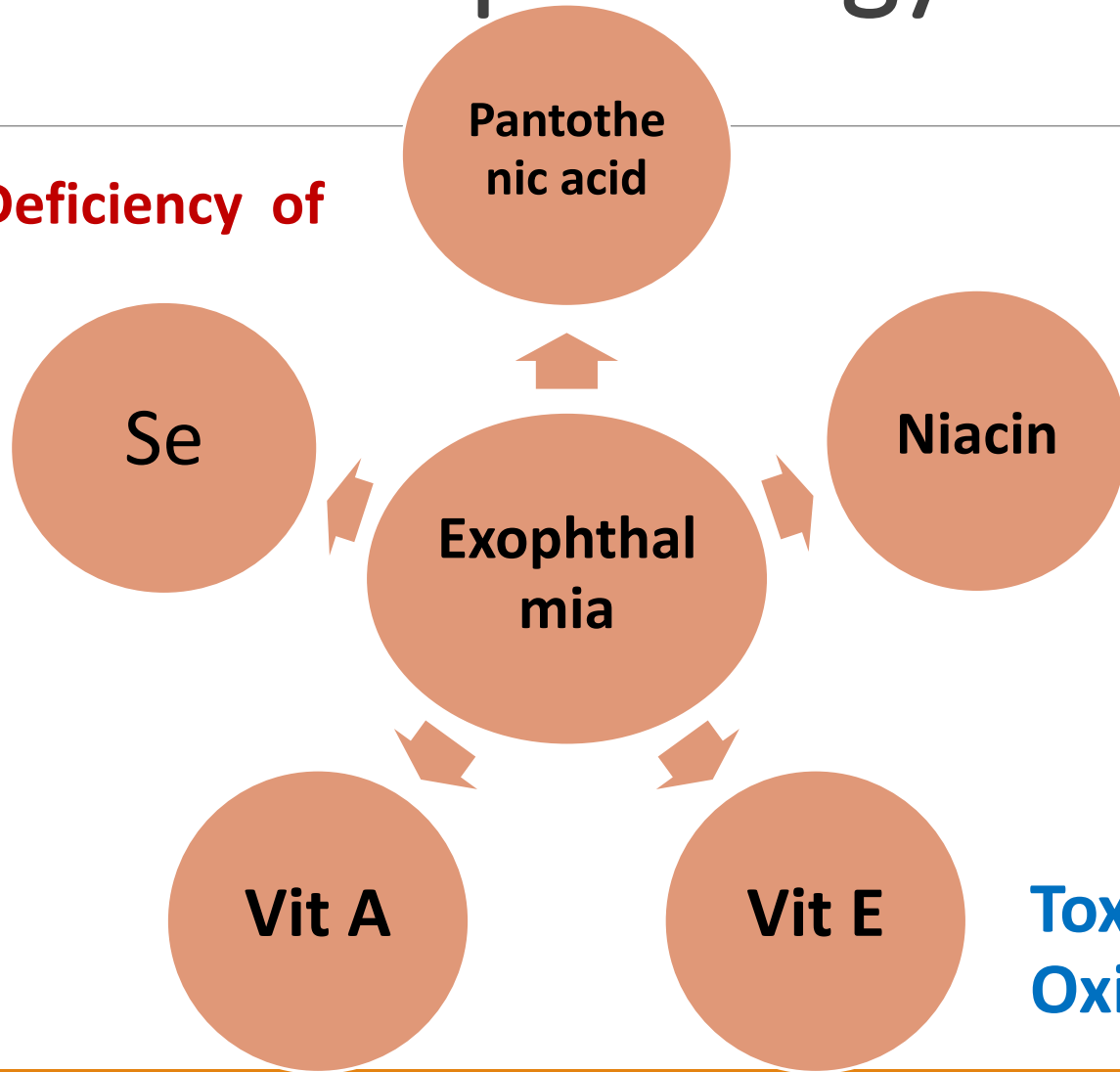


Liver histology of fish fed diets containing: (A) 43% protein and 15% lipid, (B) 43% protein and 20% lipid, (C) 47% protein and 15% lipid and (D) 47% protein and 20% lipid. In fish from groups fed with 20% lipid, hepatocyte lipid deposition was observed that was slightly improved as protein levels increased in the diets. Bars 100  $\mu$ m, 20 $\times$ .



# Nutritional pathology condition

Deficiency of



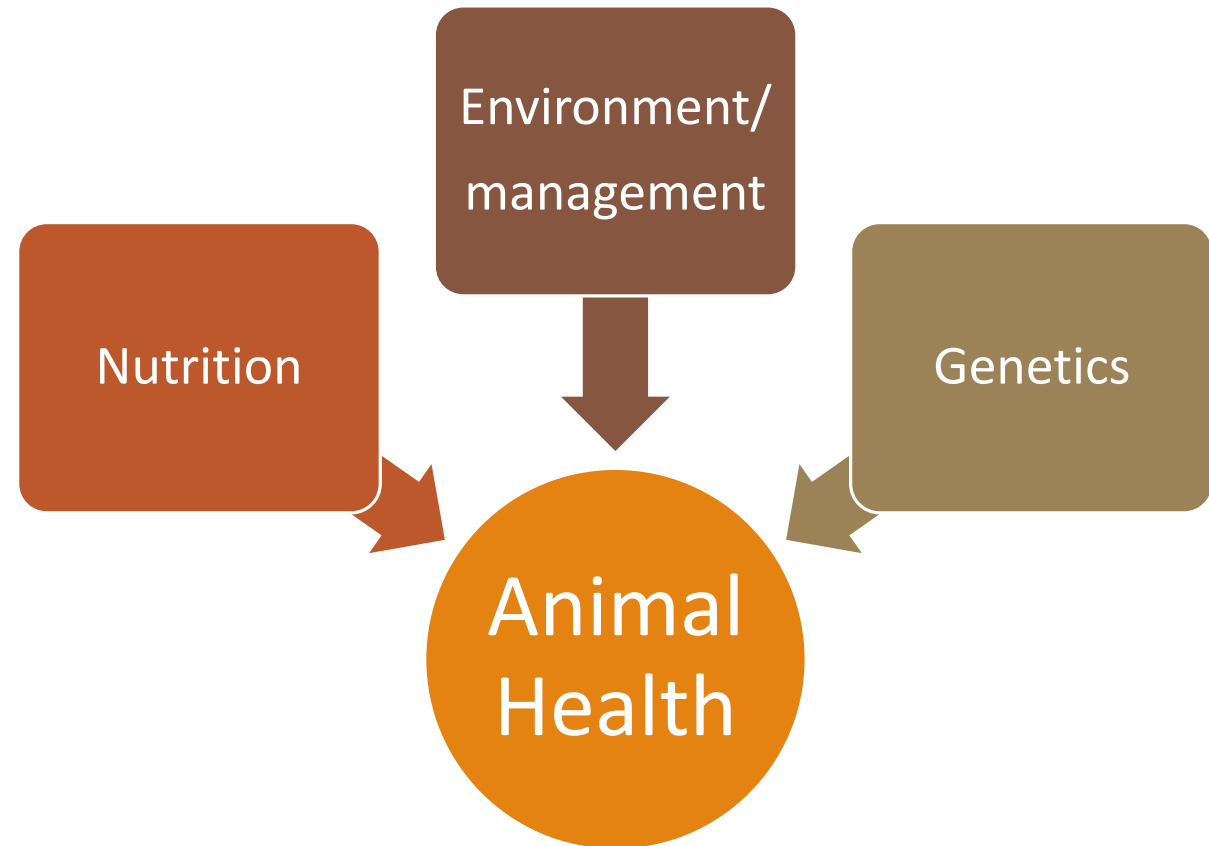
Toxicity of Oxidized fish oil

# Robustness is the property of being strong and healthy

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Under intensive condition,

Improved genetics, nutrition and production conditions /culture system are an efficient and sustainable production of healthy animals grown under intensive conditions.



# Nutrients for optimum health and disease resistance

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Nutrients and dietary components are a positive response on the health, immune response and disease resistance of finfish and crustaceans

- **Essential amino acids** :lysine, methionine, tryptophan, arginine, histidine, leucine, isoleucine
- **Nucleotides**
- **Polysaccharides** : peptidoglycans, beta 1,3, and 1,6 glucans, lipopolysaccharides

# Nutrients for optimum health and disease resistance

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- **Essential fatty acids** :18:2 omega-6, 18:3 omega-3; 20:4 omega-6, 20:5 omega-3, 22:6 omega-3 depending upon species
- **Sterols and phospholipids**
- **Essential minerals** :P, K, Mg
- **Trace elements** : Fe, Zn, Mn, Cu, Se, I
- **Vitamins** :B1, B2, B6, B12, pantothenic acid, niacin, biotin, folic acid, inositol, choline, D3, A, K3, E, and C
- **Carotenoids**: astaxanthin

### BONE, SCALE AND FIN DEVELOPMENT

Stronger bones and cartilages; improve scale resistance and appearance  
Zn, Mn, Cu

### MUSCLE DEVELOPMENT

Improve carcass and fillet yielding  
Zn, Se, Cr, Cu

### MEAT QUALITY

Improve product quality and extend shelf-life. Reduce drip loss  
Zn, Mn, Cu, Fe, Se



### NERVOUS SYSTEM

Proper development and function of the nervous system  
Cu

### FERTILITY

Improve fertility, egg and fry production  
Zn, Mn, Cu, Se, Fe

### EPITHELIAL TISSUES

Healthier gills, skin and gut  
Zn, Mn, Cu

### DISEASE RESISTANCE

Activate and modulate immune response  
Zn, Mn, Cu, Fe, Se

### FRY AND FINGERLING DEVELOPMENT

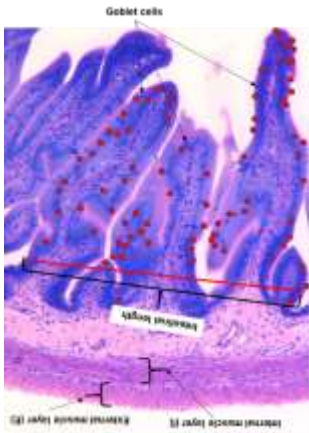
Enhanced survival, development and growth  
Zn, Mn, Cu, Se

Trace Minerals  
activate and  
modulate  
Immune  
response





For Skin, scales, fins and Gills

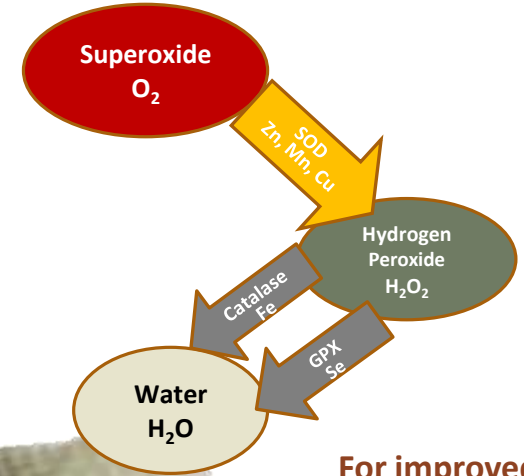


For Gut integrity



Zinc & Selenium

For Immune Response

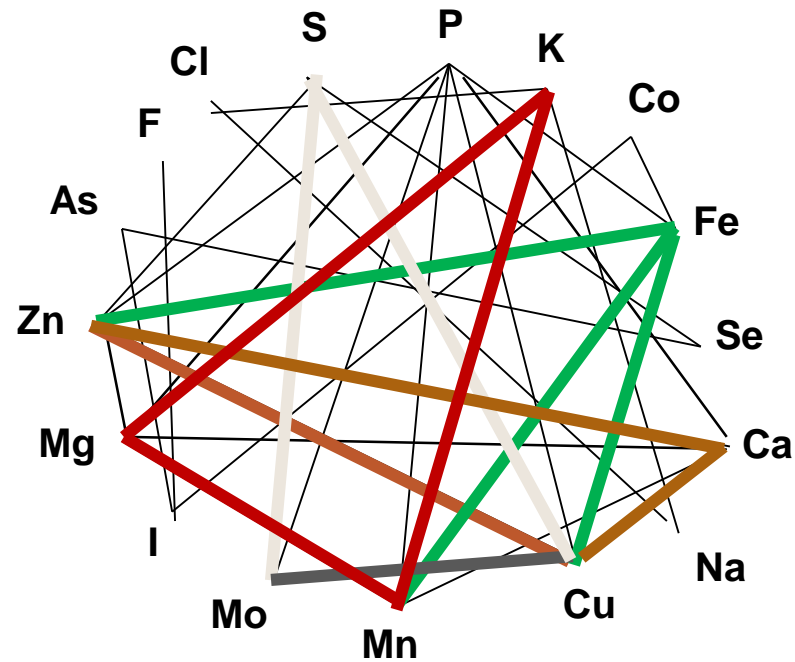


For improved Antioxidant capacity



For wound healing

# Trace Mineral Interactions



## Key Interactions

- Zn  $\longleftrightarrow$  Cu
- Fe  $\longrightarrow$  Zn, Cu, Mn
- Mo, S  $\longrightarrow$  Cu
- Ca  $\longleftrightarrow$  Zn, Cu
- K, Mg  $\longleftrightarrow$  Mn



# Summary

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**Robustness** is the property of being strong and healthy

Improved genetics, nutrition and production conditions are mandatory for an efficient and sustainable production of healthy animals grown under intensive conditions.

Essential nutrients such as protein, amino acid, essential fatty acids, vitamins and minerals are key to support animal health and decrease disease susceptibility.

Trace Minerals activate and modulate immune response

Plant base diets are more limiting in essential Trace Minerals such as Zinc and Selenium

Hence, balance nutrients in animal feed and feeding practice to get the nutrients enough for animal requirement is one of key success in fish and crustacean production

*Thanks  
For Your Attention*

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