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Vitamins an important nutritive feed ingredients used in aqua-feed

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Vitamins are diverse group of organic compounds necessary in fish diet in minute quantities for normal growth, reproduction, health and general metabolism. Vitamins reported to increase resistance to infection by increasing migration and proliferation of phagocytic cell. They are often are not synthesized by fish and must be supplied in the diet. There are 11 water solubleand 4 fat soluble vitamins.Vitamin Bcomplex, Vitamin C, Cholin and inositol are the major water-soluble vitamin which play a major role in growth, physiology and cellular metabolism. Vitamin C has antistress and antioxidant action. The water-soluble vitamins are not stored in the body tissue, therefore must be supplied to prevent deficiency. The fat-soluble vitamins include Vitamin A, D, E and K are different in chemical form and have different physiological role. Animals are the only source of fat-soluble vitamin and often recorded hypervitaminosis problem if consume in large quantity.

A balanced diet needs to ensure proportionate amount of all vitamins for maintaining good health, growth and protect the fish from avitaminosis and hypervitaminosis. There are many different factors involved to determine the vitamin requirements in fish are a) Size and age of fish b) Growth rate c) Environmental conditions and d) Nutrient relationships.

The first vitamin deficiency in rainbow trout (*Oncorhynchus mykiss*) was reported by Schneberger in 1941. Dietary gill diseases were also reported during

Table 1: Vitamins and their major functions in fish

Fat-soluble vitamins	Function
Vitamin A, retinol	Epithelial tissue maintenance, vision
Vitamin D, cholecalciferol	Bone calcification, parathyroid hormone
Vitamin E, tocopherol	Biological antioxidant
Vitamin K	Blood clotting
Water-soluble vitamins	
Thiamin, B1	Carbohydrate metabolism
Riboflavin, B2	Hydrogen transfer
Pyridoxine, B6	Protein metabolism
Pantothenic acid	Lipid and carbohydrate metabolism
Niacin	Hydrogen transfer
Biotin	Carboxylation and decarboxylation
Choline	Lipotrophic factor, component of cell membranes
Folic acid	Single-carbon metabolism
Cyanocobalamin, B12	Red blood cell formation
Ascorbic acid, Vitamin C	Blood clotting, collagen synthesis
Inositol	Component of cell membranes

(SourceHalver)

Table 2 : Vitamins, their sources and deficiency

Vitamins	Sources	Deficiencies
Water Soluble ($mgkg^{-1}$)		
Thiamin(B1)	Dried distilleries soluble, fish soluble, rice bran, wheat middling, yeast	Anorexia, poor growth, pigmentation and mortality
Riboflavin (B2)	Dried distilleries soluble, fish soluble, liver meat and yeast	Anorexia, poor growth, Abnormal swimming behavior and mortality
Pyridoxine (B6)	Dried distilleries soluble, fish meal, fish solubles, liver meat and yeast	Abnormal swimming behavior,poor growth, and mortality
Pantothenic acid	Dried distilleries soluble, cotton seed meal, fish meal, fish soluble, pea nut meal, rice bran, wheat bran, yeast	Abnormal gill features anorexia and mortality
Niacin	Blood meal, Dried distilleriessoluble, cotton seed meal, fish meal, fish soluble,pea nut meal, rice bran, wheat bran, yeast and corn gluten meal	Anorexia, poor growth, lethargy and mortality
Biotin	Dried distilleriessoluble, cotton seed meal,rice polish and yeast	Anorexia, slow growth, pigmentation
Inositol	Fish meal, liver meal, wheat germ, soy lecithin and yeast	Anorexia, slow growth,
Cholin	Cotton seed meal, fish soluble, fish meal, shrimp meal and yeast.	Anorexia, poor growth and fatty tissues
Folic acid	Dried distilleriessoluble, cotton seed meal, rice bran, soybean meal and yeast	Anorexia, poor growth and lethargy
Cyanocobalamin (B12)	Blood meal, crab meal, fish soluble, fish meal	Anorexia, poor growth
Ascorbic acid	Citrus fruit, liver, kidney, fish tissues, goose berry	Black Death
Fat soluble (IU)		
Vitamin-D	Fish liver oil, liver meals and fish meal	Poor growth, soft skeleton and lethargy
Vitamin A	Fish liver oil, liver meals	De pigmentation and soft skeleton, Keratinization of epithelial tissue
Vitamin E	Dried distilleries soluble, cotton seed meal, rice bran and wheat products	Anemia, ascites
Vitamin K	Liver meal and fish meal	Prolonged blood clotting, reduced hematocrit, lipid peroxidation

(Source, Halver)

that period which could be reduced by incorporating fresh liver or dried yeast in the diet. McCay and Tunison (1934) observed scoliosis and lordosis in brook trout (*Salvelinus fontinalus*) fed with formalin-preserved meat.

The species wise information on vitamin requirements are very little, which needs more research to produce healthy fish with proper nutrition. However, the overall the function, source and deficiency of different vitamins are discussed in tabular form (Table 1 and 2).

Conclusion : Good aquaculture practice involves the best management practices in which fish nutrition act as vital role in maintaining good health and water quality. Vitamins are need in small quantity and help in fish metabolismand growth. However, cost effective feed formulation with nutritionally balance diet needs more research, as fisheries is a very vast and diversified area.

Reference :

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