

**Table 13. Dietary nutritional deficiency, vitamins**

<b>Vitamins</b>	<b>Deficiency signs/syndrome</b>	<b>Measure</b>
Vitamin A	Reduced growth, exophthalmia, blindness, aedema	Supplement feed with vitamin A or fish liver oils
Vitamin D	Impaired bone mineralization	Supplement feed with vitamin D3 or fish liver oils
Vitamin K	Prolonged blood clotting time, haemorrhagic gills and eyes	Supplement feed with stable menadione supplements
Vitamin E	Skin depigmentation, muscular dystrophy, steatitis, cardiac muscle pathology, anaemia	Supplement feed with vitamin alpha tocopherol acetate
Thiamine	Nervous disorders, loss of equilibrium, convulsions	Supplement feed with thiamine
Riboflavin	Lethargy, dark pigmentation, fin haemorrhage and erosions, bilateral cataracts	Supplement feed with riboflavin A
Pyridoxine	Nervous disorders, loss of equilibrium, convulsions, erratic spiral swimming	Supplement feed with pyridoxine
Pantothenic acid	Clubbed gills, distended operculum, mortality	Supplement feed with pantothenic acid
Niacin	Skin and fin lesions, muscle spasms, sensitivity of skin to sunlight, abdominal aedema, convulsions	Supplement feed with niacin
Biotin	Gill lamellae degeneration, dark colouration, muscle atrophy, anorexia	Supplement feed with biotin
Folic acid	Lethargy, slow growth, anaemia, dark skin colouration	Supplement feed with folic acid
Vitamin B12	Microcytic hypochromic anaemia	Supplement feed with vitamin B12
Ascorbic acid	Lethargy, scoliosis, lordosis, anaemia	Supplement feed with stable form of ascorbic acid
Choline	Fatty liver, distended abdomen, reduced growth	Supplement feed with choline chloride
Inositol	Reduced growth, dark skin colouration, distended abdomen	Supplement feed with inositol

Source: NRC (1993)