

Table 10.3. Dietary nutritional deficiency of common carp (*Cyprinus carpio*) – vitamins¹

Vitamins	Deficiency signs/syndrome
Riboflavin	Anorexia, poor growth, high mortality rate, haemorrhage of skin and fins, nervousness, photophobia (1); Anorexia, poor growth, haemorrhages in hepatopancreas, skin and fins, emaciation, photophobia, nervousness, anterior kidney necrosis (2)
Pantothenic acid	Anorexia, reduced growth, sluggishness, anaemia, skin haemorrhage, exophthalmia (1) Anorexia, poor growth, irritability, haemorrhages in skin, lethargy, exophthalmia (2)
Niacin	Skin haemorrhage, high mortality (1); Anorexia, poor growth, poor survival, haemorrhages in skin, high mortality (2)
Thiamine	Fin congestion/haemorrhage, nervousness, fading of body colour, anorexia, poor growth (1); Poor growth, nervousness, skin depigmentation, subcutaneous haemorrhage (2)
Pyridoxin	Anorexia, poor growth, nervous disorders (1); Anorexia, ascites, ataxia, exophthalmia, convulsions, nervous disorders, anaemia, low hepatopancreatic transferase (2)
Biotin	Reduced growth, reduced activity (1); Poor growth, erythrocyte fragility and fragmentation, lethargy, increased number of dermal mucous cells (2)
Folic acid	No deficiency signs detected (1)
Vitamin B12	None detected (1)
Choline	Reduced growth, fatty liver (1); Poor growth, fatty hepatopancreas, vacuolization of hepatic cells (2)
Inositol	Reduced growth, skin and fin lesions/haemorrhage, loss of skin mucosa (1); Anorexia, poor growth, dermatitis, loss of skin mucosa (2)
Ascorbic acid	Caudal fin erosion and deformed gill arches in larval stage, poor growth (2)
Vitamin A	Anorexia, faded body colour, fin and skin haemorrhage, exophthalmia, abnormal/warped gill operculae (1); Anorexia, poor growth, exophthalmia, skin depigmentation, twisted opercula, haemorrhagic fin and skin (2)
Vitamin D	Not tested
Vitamin K	Not tested
Vitamin E	Muscular dystrophy, mortality, exophthalmia (1); Muscular dystrophy, exophthalmia, lordosis, kidney degeneration, pancreatic degeneration (2)

¹Source: (1) Tacon (1992); (2) Takeuchi, Satoh and Kiron (2002).