

Calcium, Phosphorus, and Vitamin D3 Imbalances

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Calcium/Phosphorus Imbalances

Diets that consist of seeds and grains, especially oily ones, are deficient in calcium, have a low ratio of calcium to phosphorus, and have low levels of vitamin D3. In addition, the oils in these seeds and grains may bind calcium in the intestine to form insoluble “soaps” that prevent its absorption. Due to the high-grain diet most birds are fed, the most common mineral disorders in birds are calcium and phosphorus deficiencies and imbalances.

Calcium, as the chief mineral constituent of the bird’s body and of the whole egg, is required in avian diets in larger amounts than any other mineral. Among its other purposes, it is essential for the mineralization of the skeleton; if insufficient calcium, phosphorus, or both are absorbed from the intestine, bone development will be abnormal or extremely fragile. Calcium is also required for muscle contraction, nerve impulse transmission, and many other metabolic processes.

Because calcium metabolism by the body is linked to phosphorus and vitamin D, adequate amounts of these nutrients are necessary for the proper utilization of calcium. Calcium and phosphorus are in equilibrium in the body at a ratio of 2:1. In the diet, the optimal ratio should be 2:1, although a range of 0.5:1 to 2.5:1 can be tolerated. Vitamin D3 is required for the absorption of calcium into the bloodstream from the intestinal tract.

Adult birds suffering from calcium deficiencies may become weak or ataxic (uncoordinated) and may develop bone weakness, osteoporosis, and pathological fractures. Laying hens that are not properly supplemented are at highest risk for calcium deficiency disorders. Acute hypocalcemia in laying hens is thought to result in partial paresis (weakness) and egg binding. Seen in excessive egg layers (notably unpaired cockatiels, lovebirds, and finches), this condition is often alleviated with calcium supplementation, including intramuscular injections of calcium. An acute hypocalcemic syndrome has also been seen in the African gray parrot, which may present with seizures and blood calcium levels of under 6 mg%.

In chicks and immature birds (particularly cockatiels, grass parakeets, rosellas, doves, toucans, and orphaned wild birds), calcium and vitamin D3 deficiencies are often the result of poor dietary supplementation of the hen and will often manifest as bone and joint deformities. Rickets (vitamin D3 deficiency), in the young chicken, is characterized by long-bone deformities (bowing) and folding fractures. Splay-leg deformities are not well understood, but in ratites, they have been linked to rapid growth rates and high relative protein levels in the diet.

To overcome calcium deficiencies, supplementation is essential, but it must be done properly. An excess of either calcium or phosphorus can lead to problems.

Young, growing birds fed high-calcium diets can develop kidney problems leading to kidney failure and mineralization. In addition, high calcium levels without increased levels of manganese and zinc will interfere with the absorption of these trace elements.

If too much phosphorus is provided, low calcium levels will result. The excess phosphorus will bind with calcium in the intestine to form an insoluble chemical, calcium phosphate. The remaining phosphorus is still absorbed, but blood calcium levels will be low.

Vitamin D Imbalances

The primary function of vitamin D is to regulate calcium metabolism. Vitamin D toxicosis occurs when vitamin D is present in the diet at high enough levels to stimulate the excessive absorption of calcium from the diet or its resorption from the bone. Hypercalcemia occurs, but initially (before calcium levels get too high and with a normal glomerular filtration rate [GFR] by the kidneys) the calcium can be excreted. The GFR will fall, however, when nephrolithiasis (kidney stones) occurs due to prolonged hypercalciuria (high levels of calcium in the urine), producing the elevated blood calcium levels that occur with vitamin D toxicosis.

The level of vitamin D that causes toxicosis varies with the form of vitamin D, amounts of vitamin A and calcium in the diet, and the health of the kidneys. Cholecalciferol (vitamin D3), which is used in most diets and supplements, is 10–20 times more toxic than ergocalciferol (vitamin D2) in birds that have been tested. However, ergocalciferol is not effective in replacing vitamin D3 and its function. Oversupplementation with vitamin D3 can cause kidney mineralization and widespread metastatic calcification due to the increased calcium absorption. Decreasing calcium in the diet can slow the rate of nephrolithiasis if toxic levels of vitamin D3 have been fed.

The safest and most effective way to help overcome mineral imbalances is to provide a nutritionally adequate diet, either homemade or commercially prepared (such as a formulated diet). In seed eaters, a balanced calcium/phosphorus/vitamin D3 supplement should be provided. Other sources of minerals that have been shown to be safe for birds are calcium carbonate (found, for example, in cuttlebones, plaster blocks, mineral blocks, and oyster shells), calcium gluconate supplements, liquid calcium preparations available commercially, and such natural sources as spinach, broccoli, cheese, yogurt, and milk. Crushed eggshells may also be used but must not be raw due to the risk of salmonellosis.

Care must be taken when supplementing young birds. Most commercial hand-feeding diets contain adequate levels of minerals; adding additional amounts, unless clinically indicated, can lead to mineralization of the kidneys.

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