

1. Objectives

- Explain the biochemical basis of vitamin D in dogs and cats, including its chemical structure, metabolism, and mechanism of action.
- Identify the main dietary sources of vitamin D.
- Describe the physiological functions of vitamin D in the body of dogs and cats.
- Analyze the causes and consequences of vitamin D deficiency or excess.

2. Metabolic pathway

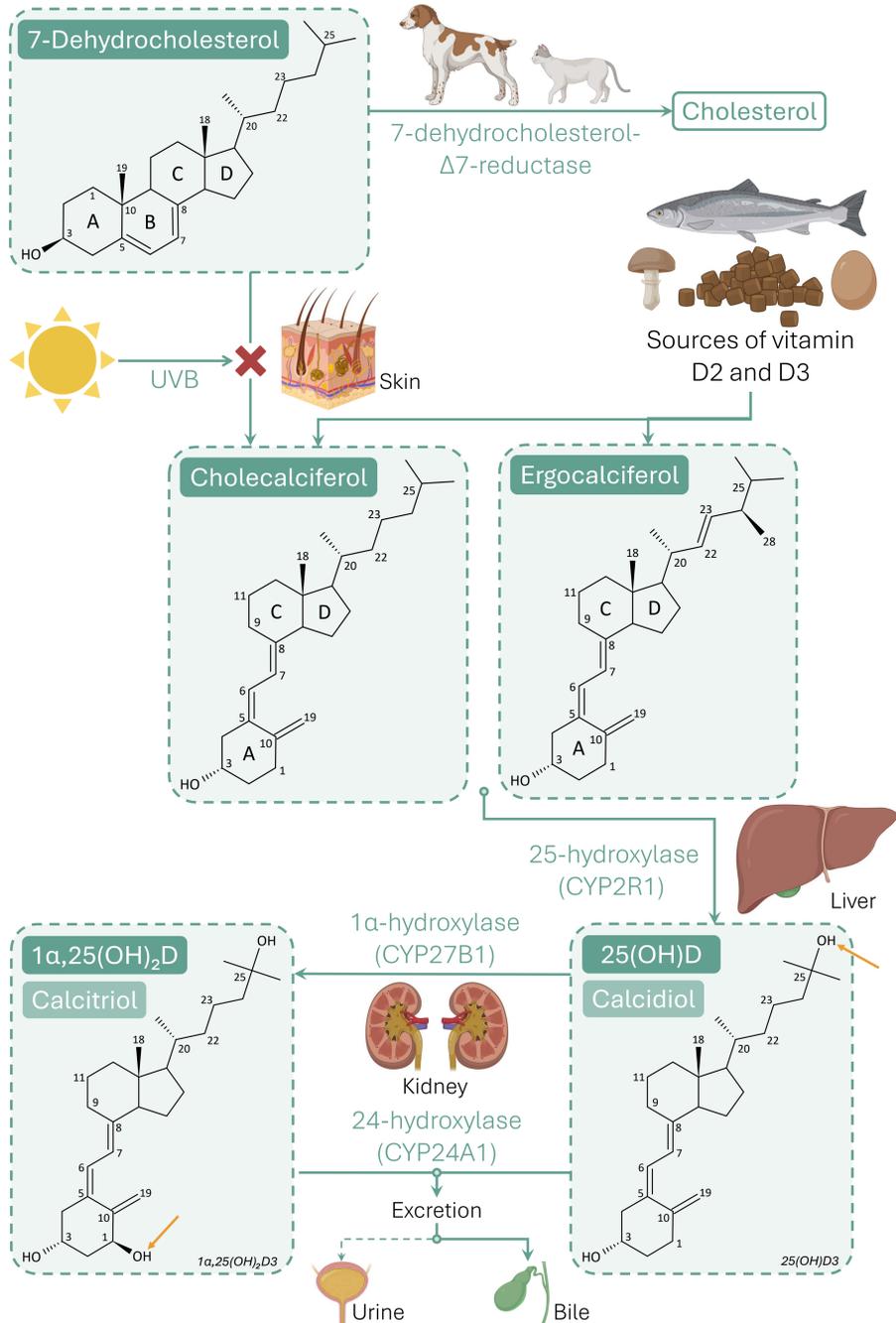


Figure 1. Structures and metabolism of vitamin D

4. Effects on calcium and phosphate homeostasis

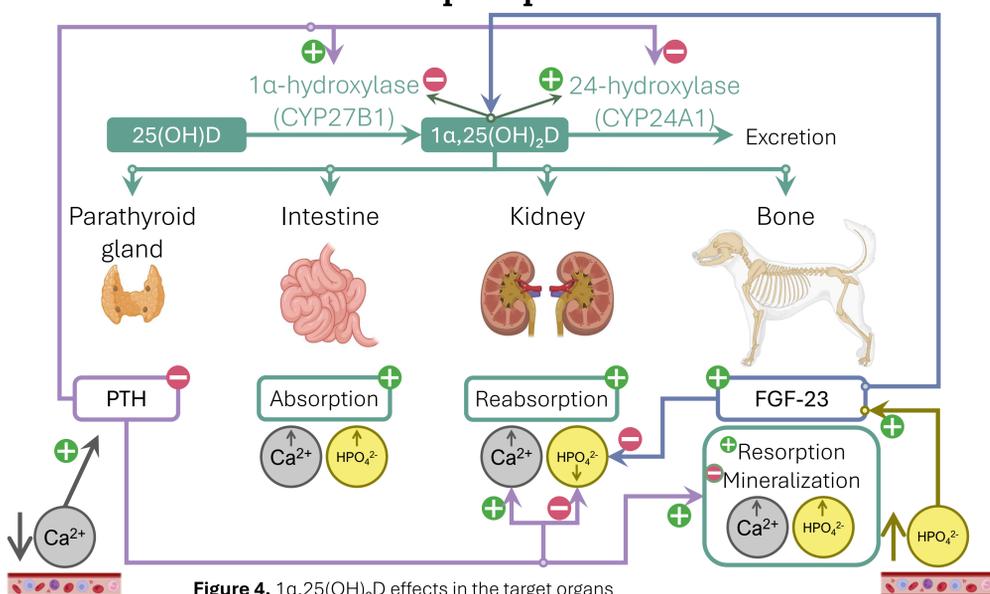


Figure 4. 1α,25(OH)2D effects in the target organs

3. Mechanism of action: Vitamin D Receptor (VDR)

Structured with 3 domains: N-Terminal Domain, DNA Binding Domain (DBD) and Ligand Binding Domain (LBD); and heterodimerize with Retinoic X Receptor (RXR).

- Rapid, **nongenomic responses**: located in the plasma membrane
- **Genomic responses**: located in the nucleus

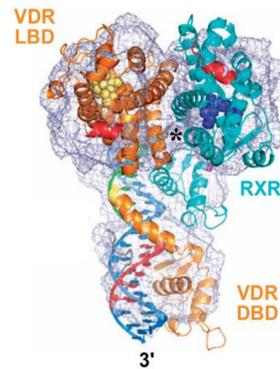


Figure 2. Structure of the human RXR/VDR nuclear receptor heterodimeric complex with its target DNA (Christakos et al. 2016).

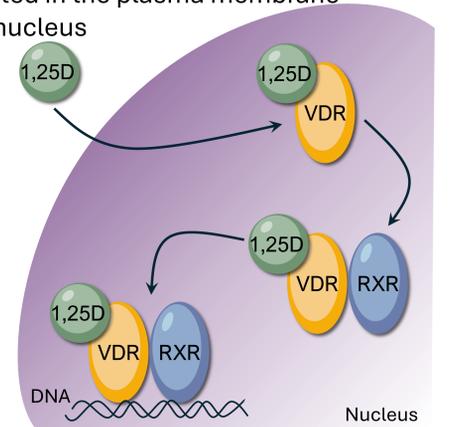


Figure 3. Schematic model showing how the 1,25D interact with the VDR localized in the cell nucleus to regulate gene transcription.

5. Imbalances in vitamin D levels

Vitamin D deficiency

Causes

- Acquired: Unbalanced diets, gastrointestinal, liver and pancreatic diseases...
- Congenital: Vitamin D-dependent rickets type 1A (CYP27B1), 1B (CYP2R1), and 2A (VDR)

Consequences

↓Vitamin D → ↓Ca²⁺ ↓HPO₄²⁻ → ↑↑↑PTH → Bone abnormalities

Rickets: in growing animals

Osteomalacia: in adults



Figure 5. Puppy with bowed limbs due to rickets (Centro Veterinario La Trinidad)

Figure 6. Radiographs of two 3-month-old cats: a, b) with rickets; c) normal (Phillips et al. 2011)

Vitamin D excess

Causes

Unbalanced diet, accidental ingestion (rodenticides, creams, plants), iatrogenic...

Consequences

Hypercalcemia: polyuria/polydipsia, gastrointestinal and neurological disturbances, soft tissue mineralization...

6. Conclusions

- Dogs and cats cannot synthesize vitamin D and must obtain it from the diet.
- Vitamin D plays a fundamental role in maintaining calcium and phosphorus homeostasis, as well as in bone remodeling.
- Imbalances in vitamin D levels are uncommon in dogs and cats but can lead to bone abnormalities, among other problems.
- Current research focuses on understanding the correlation between low vitamin D levels and the development of different diseases.