Fat-soluble vitamins (A, D, E, and K) are absorbed alongside dietary fats and can be stored in the body's fatty tissues and liver for extended periods. This storage capability means that these vitamins don't require daily intake, but it also increases the risk of toxicity if consumed in excess.

Vitamin A exists in two main forms: preformed vitamin A (retinol) found in animal products, and provitamin A carotenoids (like beta-carotene) found in plant foods. After absorption, vitamin A is essential for:

* Vision and eye health, particularly night vision
* Immune system function and barrier integrity
* Cell growth and differentiation
* Reproduction and embryonic development
* Skin health and mucous membrane maintenance
* Bone growth and tooth development

Vitamin D, often called the "sunshine vitamin," is unique because it can be synthesized in the skin upon exposure to UVB radiation. Its primary functions include:

* Calcium and phosphorus absorption in the intestines
* Bone mineralization and remodeling
* Immune system regulation
* Muscle function and fall prevention
* Cell differentiation and cancer prevention
* Mood regulation and mental health

Vitamin E comprises eight different compounds (four tocopherols and four tocotrienols), with alpha-tocopherol being the most biologically active form. Its functions include:

* Antioxidant protection of cell membranes
* Immune system support
* Prevention of blood clot formation
* Neurological function
* Gene expression regulation
* Skin health maintenance

Vitamin K exists as K1 (phylloquinone) and K2 (menaquinones), with distinct roles in:

* Blood coagulation
* Bone metabolism and strength
* Cardiovascular health
* Cellular growth regulation
* Brain function and development

Absorption of these vitamins requires adequate dietary fat and proper bile production. Various conditions affecting fat absorption, such as celiac disease, cystic fibrosis, or cholestasis, can lead to deficiencies despite adequate intake.