

# Unveiling the marvels of food chemistry: The science behind what we eat.

Biao Sing\*

Department of Clinical Nutrition, University of Santander, Santander, Colombia

## Introduction

Vitamins and minerals are crucial nutrients that the body needs to function correctly. While they are required in minute quantities compared to macronutrients like carbohydrates, proteins, and fats, their impact on health is profound. These micronutrients play pivotal roles in various biochemical processes, contributing to overall well-being and preventing a host of diseases [1].

Vitamins are organic compounds that generally cannot be synthesized by the human body (with a few exceptions like Vitamin D). They are primarily obtained from dietary sources. Minerals, on the other hand, are inorganic elements that also must be ingested, as the body cannot produce them.

Vitamins are classified into two main categories based on their solubility: water-soluble and fat-soluble. Water-soluble vitamins include the B-complex group and Vitamin C. These vitamins are not stored in the body to a significant extent and are excreted in urine, necessitating a regular intake [2].

Minerals are divided into two categories: major minerals (macrominerals) and trace minerals (microminerals), based on the amount required by the body. Calcium: Vital for bone and teeth health, muscle function, and nerve signaling. Phosphorus: Important for the formation of bones and teeth, and energy production. Potassium: Crucial for muscle function, nerve transmission, and fluid balance. Sodium: Essential for fluid balance, nerve function, and muscle contraction. Magnesium: Involved in over 300 enzymatic reactions, including energy production. Chloride: Helps maintain fluid balance and is a component of stomach acid. Sulfur: Important for protein synthesis and cellular function.

Iron: Necessary for the production of hemoglobin and oxygen transport in the blood. Zinc: Important for immune function, wound healing, and DNA synthesis. Copper: Essential for iron metabolism and neurological function. Manganese: Involved in bone formation, metabolism, and antioxidant function. Iodine: Crucial for thyroid hormone production and metabolic regulation [3].

A balanced diet is critical for providing the body with adequate vitamins and minerals. While deficiencies are rare in developed countries due to a diverse food supply, certain populations may be at risk. For example, vegetarians and vegans might need to monitor their intake of Vitamin B12 and iron, as these nutrients are more abundant in animal products. Similarly, individuals with limited sun exposure might need

Vitamin D supplementation.

While obtaining vitamins and minerals from food is ideal, supplements can be beneficial in certain situations. They can help address deficiencies, support specific health needs, and improve overall nutrient intake. However, it is crucial to use supplements wisely, as excessive intake of certain vitamins and minerals can be harmful. For instance, too much Vitamin A can lead to toxicity, while excessive iron can cause organ damage [4].

Both deficiencies and toxicities of vitamins and minerals can have serious health implications. Vitamin D: Deficiency can lead to rickets in children and osteomalacia in adults. Vitamin B12: A deficiency can cause anemia and neurological issues. Iron: Insufficient iron can result in anemia, characterized by fatigue and weakness [5].

Vitamins and minerals are indispensable for maintaining health and preventing disease. A varied and balanced diet rich in fruits, vegetables, whole grains, lean proteins, and dairy products usually provides sufficient amounts of these essential nutrients. While supplements can be helpful in certain scenarios, they should be used judiciously to avoid the risks associated with overconsumption. Understanding the roles and sources of vitamins and minerals is key to optimizing health and enhancing the quality of life [6-10].

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\*Correspondence to: Biao Sing, Department of Clinical Nutrition, University of Santander, Santander, Colombia, E mail: Hbtayeong@jissp.ac.ca

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