# Food-Grown Nutrients

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Whole foods provide the primary source of nutrients required for life. These include proteins, lipids and carbohydrates, along with vitamins, minerals, enzymes, coenzymes and phytochemicals. Studies correlate a higher intake of fruit and vegetables, which are especially rich in vitamins, minerals and phytochemicals, with decreased incidence of chronic disease.[1]

Research repeatedly confirms that nutrients are ideally ingested as part of a whole food because of the complexity and inter-relationship of macronutrients, micronutrients, and phytochemicals in foods. This complex combination of nutrient factors confers health benefits and influences nutrient assimilation and biological activity.[1-4] The essential nutrients and cofactors in whole foods enhance cellular health, cell-signaling, enzyme system response, and other activities that support physiological homeostasis.

Nutrient depletion in the soil worldwide is attributed to changes in agricultural practices since the early 1900s. Studies report median declines of up to 40% and more of minerals, vitamins, and proteins in food.[5,6] Additionally, environmental challenges and other issues contribute to cellular stress, inflammation, nutrient imbalance, and an increased need for nutrients to maintain physiological homeostasis. Many people today supplement their diet with herbs and nutrients to compensate for this loss of nutrition from food and to enhance their health.

## FOOD MATRIX

Food-grown nutrients are a unique form of nutritional supplement that are recognized and assimilated by the body as foods. They could be more accurately called a nutriment, which is defined as something that nourishes or promotes growth, provides energy, repairs body tissues, and maintains life.[7] A supplement, on the other hand, is defined as something that is added to something else in order to make it complete.[8]

Nutrients in foods are most often contained within a natural cellular compartment or microstructure within the whole food complex. Food-grown nutrients are incorporated into a food matrix through a natural process. This process leads to a highly biologically active form of the nutrient which is bonded in a food matrix and nutrient complex just as it would naturally be in food.

This is achieved through a proprietary process utilizing site-selective carriers which integrate supplemental vitamins and minerals into a food matrix. Structuring matrices for nutrient delivery is a subject of enormous scientific interest and many matrix materials are being studied. A food matrix consists of proteins, complex carbohydrates, lipids, bioflavonoids, and fiber into which site-selective carriers integrate vitamins and minerals.

Many food-grown nutrients are grown using *Saccharomyces cerevisiae* (nutritional yeast) using a unique re-naturing process that is comparable to hydroponic gardening. The water used for this process undergoes a comprehensive seven-step purification process using two stainless steel tanks. The first tank is a reactor where the supplemental substance to be grown (for example, selenium) is nutrient-activated in a food broth where it attaches to specific carrier proteins. Once the food-broth stage is complete, the nutrient is slowly introduced into the second stainless steel tank containing the nutritional yeast.

Here the nutrient's specific proteins attach to receptor sites in the yeast by displacing some of the sulfur-containing amino acids. Through the innate intelligence of the carrier proteins, the nutrient (selenium in this example) is delivered to a specific location in the yeast cells where it becomes naturally-bonded with the yeast, thus creating a food matrix.

*Concept of bioavailability incudes:*[10]

1. release of nutrients from its matrix
2. absoprtion, which includes:
   - availability for absorption (bioaccessibility)
   - absorption through metabolic pathways
3. bioactivity, which includes:
   - distribution to the tissues
   - storage in nutrient pools
   - metabolic utilization of the nutrient

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*Bioavailability is influenced by:*[10]

1. Exogenous factors
    - the food matrix
    - the chemical form of a nutrient
    - co-ingested compounds (can increase or decrease absorption)
    - dosage
2. Endogenous (individual) factors
    - nutrient and health status
    - digestive system status
    - age

Throughout the growing process, levels of the individual nutrients are tested at regular intervals. When peak levels of the nutrient are reached, the yeast is harvested. The yeast cell wall membrane is then broken with plant-based proteolytic enzymes to facilitate bioavailability. The food-grown nutrient is carefully dried using low heat and an exacting process developed to maintain fragile enzymes and nutrients. This growing process is used for vitamin D, B-complex vitamins, CoQ 10, and all minerals because of the availability of specific receptor sites for each of these nutrients on the yeast cells.

*S. cerevisiae*, however, does not contain any vitamins C, E, beta-carotene, or K. Hence, these nutrients are reacted with concentrates that have a close affinity with the nutrient (for example, a citrus extract for the vitamin C). This ensures the formation of a bioavailable food complex.

## YEAST FOOD MATRIX

The cell structure and physiology of *S. cerevisiae* facilitates efficacious utilization of nutrients and is known to be easily digestible as a food matrix. Since the yeast cell wall membrane is broken at the end of the process (using plant-based proteolytic enzymes), this further facilitates absorption, bioavailability and bioactivity of nutrients.

*S. cerevisiae* is used as a nutrient medium because it is highly regarded for its unique characteristics. Many types of yeasts have been traditionally used in food processing and preservation since ancient times. Yeasts are shown to exert a beneficial influence on human health and *S. cerevisiae* is particularly valued and researched in this respect. *S. cerevisiae* is found to have a probiotic effect, to benefit epithelial barrier integrity, to exert anti-inflammatory influence, and to exert anti-toxic influence on mycotoxins. Nutritionally, it is found to help increase the bioavailability of divalent minerals, including iron, zinc, calcium, and magnesium.[9]

There are numerous studies on the uptake of trace metals by *S. cerevisiae* which is noted for its ability to take up and incorporate nutrients into its structure. Study of *S. cerevisiae* yeast has been instrumental in helping scientists discover and understand mineral transport systems. This yeast is found to be an ideal delivery vehicle for mineral supplements because of its ability to incorporate metals into its cells. This is attributed to the high concentration of proteins in yeast along with mineral receptor sites. *S. cerevisiae* is able to accumulate metal ions from aqueous solutions through several mechanisms and can incorporate substantial amounts of minerals into its structure.[10,11]

*S. cerevisiae* yeast is of great interest to scientists for many reasons. One reason is due to its high nutritional content, which benefits both humans and animals.[12] Minerals grown on *S. cerevisiae* are found to contain various immune-enhancing compounds such as β-glucan, nucleic acids, mannan oligosaccharides and chitin.[10] Mineral-enriched yeast is found to be significantly more biologically available than the gluconate forms in animal and human studies.[13,14]

## BIOAVAILABILITY AND BIOACTIVITY

Bioavailability is the proportion of a nutrient that is digested, absorbed and metabolized by the body or the proportion of a nutrient that is capable of being absorbed and available for use or storage.[15,16] Factors that influence the fate of an ingested nutrient include the nutrient's chemical state, its release from the food matrix, metabolic factors, and interactions with other nutrients, inhibitors, or cofactors.

The physical properties of the food matrix influence the bioavailability of nutrients. Nutrients are released from the matrix during digestion for absorption through the gut.[17] Food-grown nutrients are carefully and naturally processed to enhance release of nutrients from the food matrix.

Bioactivity refers to the impact of ingested compounds on metabolism and nutrient pools. Nutrients that are absorbed enter the system where they are distributed to cells and tissues. Nutrients are often stored in nutrient pools, so intake of any nutrient influences the concentration of nutrients within a pool and impacts the concentration in other pools.[18]


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BIOAVAILABLE, EFFECTIVE NUTRITION

Health is largely determined by dietary and lifestyle factors that influence epigenetic processes, metabolism, and homeostasis. Eating a wide-variety of nutrient-rich, organic, whole foods supplies a diverse and synergistic blend of vitamins, minerals and phytochemicals along with proteins, fats, carbohydrates, enzymes and other factors that influence cellular function and human health.

Human physiology is designed to obtain nutrients from plants and natural foods. Nutrients occur in whole foods as complexes, offering a natural synergy. Nutritional compounds delivered as a food concentrate or in a food matrix offer nutrients contextually with naturally-occurring supportive cofactors as a food complex, rather than a nutrient isolate.

Food-grown nutrients offers vitamins and minerals within a food matrix which the body recognizes as a food complex. This naturally facilitates absorption, enhances bioavailability, and supports bioactivity at the cellular level for metabolic processes. The food matrix includes peptide carriers and cofactors naturally-occurring in foods that act as chaperones, delivering nutrients to the cells and tissues of the body. Food-grown nutrients are designed to emulate whole foods while delivering a specific concentration of specific vitamins or minerals to enhance nutritional intake. Food-grown nutrients are ideal because of their innate compatibility with human biochemistry and physiology.

## *References*


1. Carr AC, Vissers MCM. S*ynthetic or food-derived vitamin C – are they equally bioavailable?* Nutrients. 2013 Nov. 5(11):4284-4304.
2. Vinson JA and Bose P. *Comparative bioavailability to humans of ascorbic acid alone or in a citrus extract*. Am J Clin Nutr. 1988 September. 48(3):601-604.
3. Vinson JA, Jang J. *In Vitro and In Vivo Lipoprotein Antioxidant Effect of a Citrus Extract and Ascorbic Acid on Normal and Hypercholesterolemic Human Subjects*. J Med Food. 2001 Winter. 4(4):187-192.
4. Szent-Gyorgyi A. *Oxidation, energy transfer, and vitamins*. Nobel Lecture. December 11, 1937.
5. Scheer R, Moss D. *Dirt Poor: Have Fruits and Vegetables Become Less Nutritious?*. Scientific American online. 2011 April 27. http://www.scientificamerican.com/article/soil-depletion-and-nutrition-loss/
6. David DD. *Declining Fruit and vegetable nutrient composition: what is the evidence?* Hort Sci. 2009 February. 44(1):15-19.
7. Merriam-Webster dictionary online. http://www.merriam-webster.com/dictionary/nutriment
8. Merriam-Webster dictionary online. http://www.merriam-webster.com/dictionary/supplement
9. Moslehi-Jenabian S, Pedersen LL, et al. *Beneficial effects of probiotic and food borne yeasts on human health*. Nutrients. 2010 April. 2(4):449-473. doi: 10.3390/nu2040449
10. Gharekhani A, Takami GA, et al. *Effects of diet supplementation with zinc enriched yeast on blood indices and some biochemical parameters in rainbow trout (Oncorhynchus mykiss)*. Biological Forum – An International Journal. 2015. 7(1):940-944.
11. Shet AR, Patil LR, et al. *Enrichment of Saccharomyces cerevisiae with zinc and their impact on cell growth*. Biotechnol Bioinf Bioeng. 2011. 1(4):523-527.
12. Vinson JA, Bose P. *Comparison of the bioavailability of trace elements in inorganic salts, amino acid chelates and yeast*. Proceedings on Mineral Elements. 1981. 615-621.
13. Vinson JA, Tompkins TA, Agbor GA. *Comparative bioavailability of mineral-enriched gluconates and yeast in rat liver after depletion-repletion feeding*. Biol Trace Elem Res. 2007 Aug. 118(2):104-110.
14. Tompkins TA, Renard NE, Kiuchi A. *Clinical evaluation of the bioavailability of zinc-enriched yeast and zinc gluconate in healthy volunteers*. Biol Trace Elem Res. 2007 Winter. 120(1-3):28-35.
15. 15. Srinivasan VS. Bioavailabiity of nutrients: a practical approach to in vitro demonstration of the availability of nutrients in multivitamin-mineral combination products. J Nutr. 2001. 1349S-1350S.
16. Gibson RS. *The role of diet- and host-related factors in nutrient bioavailability and thus in nutrient-based dietary requirement estimates*. Food and Nutrition Bulletin. 2007. 28(1):S77-S100.
17. Parada J, Aguilera JM. *Food microstructure affects the bioavailability of several nutrients*. J Food Sci. 2007 April. 72(2): R21-R32. DOI: 10.1111/j.1750-3841.2007.00274.x
18. Briviba K. *Definition of bioavailability from the viewpoint of human nutrition*. BfR-Symposium Presentation. 2013. Jan 16-17.