MichaelMooney.net
Fact Versus Fiction
Analysis of Studies from the National Library of Medicine

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WHY I CREATE RESEARCH REVIEWS

I am frequently asked about forms and dosages of nutritional supplement ingredients.

Research Reviews provide information to answer these questions.

Scientific references are cited and text from abstracts is included to provide research details and background.

I evaluate ingredients and dosages by the following criteria:

1) Is it natural to and easily used by the human body?
2) Has it had a long history of safe use in humans?
3) Is it supported by science or traditional herbal wisdom?
4) Is it nutritionally effective?
5) Is it cost-effective?
6) Is it concentrated enough that optimal doses can be supplied in a reasonable amount of tablets?

Comparison: "Whole-Food-Grown" Nutrients And USP-Type Nutrients

Question: Are "whole-food-grown-type" nutrients also called "cultured whole-food probiotic-type," "food-state-type" or "food-matrix-type" nutrients that come from food more natural than pure USP-type isolated nutrients?

Answer: **"**Whole-food-grown-type" nutrients are USP-type nutrients combined with food materials in laboratory processes. They are not more natural than USP nutrients. They are food supplements, not food.

Question: Don't scientific studies show that "food-grown-type" nutrients absorb better and are more bio-available than USP-type nutrients?

Answer: The few published studies of "food-grown-type" nutrients did not confirm any kind of superiority. Read the study details inside.

Question: Doesn't a Nobel Prize winner's work confirm "food-grown-type" nutrient claims about superior absorption caused by protein chaperones?

Answer: The Nobel Prize winner said that use of his name is *"utter nonsense"* and the claim is "*not supported by my work.*" See page 13.

Question: Aren't high-potency USP nutrients toxic?

Answer: High-potency USP nutrients are proven to be safe and more effective than low potency nutrients in over 22,000 published studies. See page 15.

INSIDE

Background Information

In the late 1960's, after suffering poor childhood health, I happened upon the work of pioneering doctors who had discovered how optimal nutrition could improve human mental and physical health, increase intelligence and potentially increase healthy life spans. This approach improves basic cellular chemistry by combining a natural whole foods diet, regular exercise, stress reduction, allergy control and the use of progressive dietary supplements. These consist of higher, more optimal potency "orthomolecular" vitamins, minerals and other nutrients. (Orthomolecular means natural, health-supporting nutrients in optimal potencies.)

From the initial discoveries by a few hundred nutritionally-oriented doctors in the 1950's and 60's, investigations grew to over 22,000 published studies verifying the effectiveness of optimal potency vitamin and mineral supplements. Independently published studies confirmed that, in general, effective potencies were much higher than Recommended Daily Allowance (RDA) potencies. RDA levels are the minimum doses that prevent people from developing the basic nutrient deficiency diseases, like scurvy. The higher, optimal range potencies are those that have been shown in studies to be more effective than RDA levels at increasing over-all health. They provide such benefits as a reduction in birth defects, improved heart health and increased bone density. Therapeutic potencies, which are higher than optimal potencies, are prescribed by nutritionally-oriented doctors for diseases like schizophrenia, multiple sclerosis and arteriosclerosis. (See the Vitamin Safely Table, page 15).

Optimal-range potency formulas, like all other multi-vitamins commonly sold in the United States, utilize nutrients called "USP-type nutrients." USP stands for *United States Pharmacopoeia*, a standard for measuring the purity of isolated nutrients. USP-type nutrients have been taken on a daily basis by millions of people for over 60 years. All of the over 200,000 independently published scientific studies showing benefits for vitamin supplements for over 60 years have been conducted using USP-type vitamins. USP-type nutrients are synthesized in laboratories to replicate nutrients found in food. Studies confirm that they duplicate the benefits of nutrients found in food. (To read more about this, see *Natural Versus Synthetic* on page 2.)

In the 1980's, a type of nutrient combination product, called "food-grown-type" also called "whole-food probiotic type," "food-matrix-type" or "food-state-type" nutrients, was introduced to natural food stores. "Food-grown-type" nutrients are standard, isolated USP-type nutrients that are combined with food materials, like yeast, soy, probiotics or citrus in proprietary laboratory processes, some of which involve fermentation or culturing. These laboratory processes were claimed to increase nutrient absorption and utilization significantly, supposedly making very low doses of these nutrients more effective than higher doses of pure, isolated USP-type nutrients. One premise of the claims was that the laboratory process causes the USP-type nutrients to become attached to proteins (or something not identified) in the yeast or other food materials, and that the proteins escort the nutrients into the body more effectively. (See page 12: Protein Carriers.)

Claims were also made that "food-grown-type" nutrients are somehow safer and less "toxic" than pure USP-type nutrients. This claim commanded evaluation because USP-type nutrients are used to make "food-grown-type" nutrients. USP-type nutrients are tested for purity before they are released for distribution to dietary supplement manufacturers. USP-type nutrients have been shown to be safe and non-toxic at supplemental doses by conservative United States government organizations that have evaluated them for over 60 years. While "food-grown-type" USP nutrients are not necessarily hypoallergenic, pure, isolated USP-type nutrients can be hypoallergenic, so that they do not cause allergic reactions.

During this same period of time, another type of nutrient formula, called food-based vitamins, appeared in natural food stores. Food-based formulations are simply USP-type nutrients mixed with food materials, like alfalfa, chlorella or spirulina, but without the fermentation, culturing or other laboratory processes involved in the manufacturing process that produces "food-grown-type" nutrients.

The foods in food-based tablets contain small amounts of phyto-nutrients that can have a small amount of value. While claims have also been made that a food-base improves nutrient absorption, there are no scientific studies that support the notion that nutrient absorption or utilization are enhanced by simply mixing food materials with USP-type nutrients in a tablet. A tablet amount of food is not enough to aid absorption. To slow digestive transit time enough to allow for optimal absorption, vitamins should be taken with a meal (224,000 mg = ½ pound), rather than a tablet amount of a food base (1,000 mg).

In this issue of *Research Reviews* I share details that I have uncovered in the available scientific and other literature that compare "food-grown-type" nutrients to pure USP-type nutrients. I also show why I do not personally use "food-grown-type" nutrients by comparing them to USP-type nutrients using six standards.

Ingredients Should Pass Six Standards

1) Is it natural and normal to the human body?
2) Has it had a long history of safe use in humans?
3) Is it supported by science and/or traditional herbal wisdom?
4) Is it nutritionally effective?
5) Is it cost-effective?
6) Is it concentrated enough that one can obtain optimal potencies in a reasonable number of tablets?

Three Investigations: 1984, 1994, 2001

In 1984, I investigated claims about "food-grown-type" nutrients to determine whether using them would be beneficial. "Food-grown-type" nutrients were found to cost 8 to 14 times more than USP-type nutrients and require at least 4 to 8 times as many tablets to provide equal doses. The nutrient doses in "food-grown-type" formulas were and still are much lower than nutrient doses provided by optimal-range potency formulas. For instance, while an optimal-range potency multi-vitamin generally provides 1,000 mg or more of calcium per day, the highest potency "food-grown-type" multi-vitamin provides about 200 mg of calcium per day in six tablets, 1/5th as much calcium. If I elected to use these products, I would no longer be able to use optimal-range potencies. This change would have to also justify a significantly higher cost, the much lower potencies of nutrients and the greater number of tablets required.

In addition, the only studies I found that investigated "food-grown-type" nutrients were funded by "food-grown-type" nutrient manufacturers. I found no independent studies. The manufacturer-funded studies, while suggestive, did not adequately support claims that "food-grown-type" nutrients were better absorbed or were more effective than pure USP-type nutrients. I also had concerns about allergies to yeast and possible aggravation of other allergies. Therefore, I elected not to use "food-grown-type" nutrients.

Ten years later, in 1994, I again analyzed data regarding "food-grown-type" nutrients, this time to answer questions from friends on further claims that "food-grown-type" nutrients were more effective than USP-type nutrients. Again I found no independent published scientific research that showed enhanced effectiveness or absorption for "food-grown-type" nutrients. The cost was still high, actually even higher than it was 10 years earlier and the nutrient concentration still low, so I again elected not to use "food-grown-type" nutrients.

Seven years later, in 2001, because of new questions, I reviewed the available manufacturer-sponsored studies (three of the studies are reviewed later in this document), and examined new claims. I scanned the 11 million studies in the National Library of Medicine for studies about "food-grown-type" nutrients, and again found no independent studies. I also found no published data supporting claims that the yeast (Saccharomyces cerevisiae) in "food-grown-type" nutrients would not cause yeast allergies. Numerous studies confirmed that it would. I questioned scientists who were mentioned in promotional literature about "food-grown-type" nutrients and found that they did not know that their names were being used and disavowed association with the claims. I also reviewed a Federal Court ruling on the claim that "food-grown-type" nutrients were bonded to proteins. The court *"determined there is no scientific basis to conclude that ["food-grown-type"] vitamins are bonded to proteins."* I also discovered that in 1989, the National Nutritional Foods Association's (NNFA) Committee for Product and Label Integrity stated that claims for enhanced absorption of "food-grown-type" nutrients *"are not supportable and are not in the best interest of the health food industry."*

As in 1984, because there were still many unanswered questions and concerns, and contrary information, and no independent scientific studies to support claims of superiority, I again elected not to use "food-grown-type" nutrients and continued to use only optimal potencies of USP-type nutrients.

Claim: Natural Versus Synthetic

One claim made about "food-grown-type" nutrients is that "food-grown-type" nutrients are said to be more "natural" than USP-type nutrients and that they are *"whole foods."*

While the words "food-grown-type" can create a first impression that they are extracted directly from whole fresh foods, like broccoli, kale or oranges, this is not the case. As was stated previously, to produce "food-grown-type" nutrients, USP-type nutrients are introduced into cultures of yeast, probiotics or other food

materials. The cultures are dried and then used in dietary supplements as sources for the individual nutrients. These dried cultures are edible, therefore they are being called *"whole foods"* and "food-grown-type" nutrients.

To be clear, all vitamins and minerals in multi-vitamins, whether combined with foods or herbs, are synthetic, synthesized to duplicate the activities of food nutrients in the body. "Food-grown-type" vitamins are no exception.

Synthesis is simply defined as *"combining parts to make a whole."* Laboratory synthesis replicates natural vitamin molecules. USP-type vitamins are created this way. While synthesized molecules are sometimes misunderstood as being harmful or not producing beneficial effects, this is not the case. In fact, all of the over 200,000 published studies that have demonstrated the benefits of vitamin and mineral supplements for over 60 years have been conducted using synthesized USP-type nutrients, including studies of "food-grown-type" nutrients.

As an example, one study of "food-grown-type" nutrients that was funded by a "food-grown-type" nutrient manufacturer confirms that "food-grown-type" calcium is produced by combining USP-type calcium chloride in a laboratory procedure with protein, starch, water, and yeast. (See a review of the study on page 5.) Combining several ingredients in a laboratory procedure to create another product is literally defined as "synthesis," so "food-grown-type" calcium is actually "synthetic" by definition.

According to *Hawley's Condensed Chemical Dictionary, 13th Edition,* the calcium chloride that is used to manufacture "food-grown-type" calcium is itself synthesized in a laboratory, usually by processing the most abundant natural form of calcium, calcium carbonate, in a chemical reaction with hydrochloric acid.

While marketing literature for "food-grown-type" nutrients often describe them as *"food"* or as *"100% whole food,"* something that is synthesized cannot literally be considered to be the same as whole food. Since "food-grown-type" nutrients are created in a laboratory process like USP-type nutrients, they are also synthetic.

Claim: Superior Absorption

People generally assume that "food-grown-type" nutrients absorb better than USP-type nutrients because it is assumed that nutrients in whole foods absorb better than USP-type nutrients. However, published studies show that only a few nutrients in foods absorb as well as USP-type nutrients. None absorb significantly better than USP-type nutrients. **See: http://www.michaelmooney.net/nutrientabsorption.html**

Supplemental calcium absorbs similarly to calcium from kale, a green leafy vegetable.

1. Calcium from kale, a dark green leafy vegetable, known as a superior source of calcium, absorbed at 40.9% in one study. (Heaney RP. Am J Clin Nutr 1990,1(4):656-657.)

   Another study showed that calcium carbonate absorbed at 39%. [Sheikh MS. N Engl J Med 1987;317(9):532-536]

   Yet another study showed that calcium citrate also absorbed at 39%. [Harvey JA, et al. J Am Coll Nutr (1990) Dec;9(6):583-587]

   Calcium from kale, a best calcium food source absorbed in the same basic range as calcium carbonate and calcium citrate, around 40%, in these studies.

While some nutrients in food absorb equally to USP-type nutrients, most nutrients in foods like folic acid, do not absorb as well as supplemental USP-type nutrients and *are not as effective for critical benefits*, such as folic acid supplementation reducing the incidence of birth defects.

Supplemental folic acid absorbs better than folic acid in foods.

1. Supplemental USP-type folic acid has been shown to absorb about 40% better than folic acid found in food. (Neuhouser ML, et al. Absorption of dietary and supplemental folate in women with prior pregnancies with neural tube defects. J Am Coll Nutr 1998 Dec;17(6):625-630.)
2. In one placebo-controlled study, 400 mcg of pure supplemental USP-type folic acid reduced homocysteine by 20%, while 400 mcg of folic acid from a plant-food source reduced it by only 9%. Lower blood levels of the amino acid homocysteine are associated with lower incidence of spina bifida, a common birth defect. Supplementing with USP-type folic acid is recommended to protect newborn babies from birth defects. (Riddell LJ, et al. Dietary strategies for lowering homocysteine concentrations. Am J Clin Nutr 2000;71:1448-1454.)

Investigations Of Scientific Studies: 1984 to 1994

USP-Type Nutrients Have Been Investigated In Independent Studies "Food-Grown-Type" Nutrients Have Not

While there are over 200,000 independent published scientific studies showing the safety and effectiveness of pure USP-type nutrients, I found no independent published studies of "food-grown-type" nutrients. Some small private studies of "food-grown-type" nutrients have been conducted, but all of the available published studies were funded by "food-grown-type" nutrient manufacturers and conducted by one paid researcher.

One of my six criteria for the use of an ingredient is that it must be supported by science. Small studies sponsored by manufacturers are not considered adequate by the scientific community to support use in humans. USP-type nutrients are supported by independent studies. "Food-grown-type" nutrients are not.

Comments About Studies Of "Food-Grown-Type" Nutrients

There were more causes for concern and more questions unresolved after searching for studies and published data supporting claims about the enhanced effectiveness of "food-grown-type" nutrients over USP-type nutrients.

1. Only two studies on "food-grown-type" nutrients could be located in peer-reviewed medical journals that are accessible on Medline, the National Public Library of Medicine's database. Another study was published in a peer-reviewed journal that is not available on Medline. Four studies were published in a journal that did not appear to conform to peer-review standards that is not published any longer.
2. These seven studies and approximately 50 other papers that were not published in medical journals were conducted by one paid researcher and funded by "food-grown-type" nutrient manufacturers. All of the studies located involved only small human populations with limited reported data, were done using animals rather than humans, or were test-tube studies. Some of these reports were short (only a few paragraphs), not referenced, and abbreviated, apparently not meant for publication. No independent studies of "food-grown-type" nutrients were found to have been published.
3. Other studies funded by a "food-grown-type" nutrient manufacturer were conducted by two other researchers, but they have neither published the results nor conducted more studies. In 1989, the text of a court case revealed that one of the researchers protested the use of their data, *"It becomes apparent that these [study] results have been manipulated for commercial purposes. I, therefore, insist that our names be excluded from further references, since these figures misrepresent a true depiction of our data... I feel it necessary that we be consulted before our names are used to fictionalize the true facts."* (US District Court, Northern District of Calif., No. C-88-20496-SW, Exhibit I, Jan. 18, 1985) The court then ruled that using the researchers' graphs was *"false advertising."* (Permanent Injunction: 7/25/89) This raises concerns that other data in studies of "food-grown-type" nutrients may be being manipulated for commercial purposes.
4. Studies of "food-grown-type" nutrients frequently used doses that were significantly higher than doses that can be provided in a reasonable number of tablets because of the amount of space "food-grown-type" nutrients require**.** A study of "food-grown-type" calcium, reviewed on page 5 investigated 500 mg of calcium. This would require 10 to 62 tablets of the available "food-grown-type" nutrient products. The study of "food-grown-type" Vitamin C on page 7 investigated 500 mg and 2,000 mg doses, which require 2 to 8 tablets of "food-grown-type" Vitamin C, compared to 1 to 2 tablets of USP-type Vitamin C. One of my criteria for use of a product is that it must deliver optimal nutrition in a small number of tablets. USP-type nutrients require less tablets than "food-grown-type" nutrients to provide an equal dose.
5. Since the studies investigated much higher doses than are possible to include in "food-grown-type" nutrient tablets, these studies do not substantiate claims about the effects of low potencies of "food-grown-type" nutrients. Independent studies of low doses of "food-grown-type" nutrients have to be conducted and published in peer-reviewed journals to verify that there are any benefits. Thousands of studies have shown that higher potencies of nutrients are required to be effective. This may be why published human studies of "food-grown-type" nutrients use high potencies and not low potencies.
6. The manufacturer-funded studies, three of which are reviewed in this report, do not support the notion that "food-grown-type" nutrients are absorbed or utilized better in humans than USP-type nutrients or that the benefits they might deliver are equitable when compared to USP-type nutrients.

A Closer Look At Three "Food-Grown-Type" Studies
Study #1: "Food-Grown-Type" Calcium Versus Calcium Gluconate

Vinson JA, et al. Comparison of different forms of calcium on blood pressure of normotensive young males. Nutri Rep Int Sept 1987;36(3):497-501.

Study # 1: This study compared 500 mg of powdered "food-grown-type" calcium (which is synthesized from calcium chloride) with 500 mg of calcium gluconate. It provided data that asserted that "food-grown-type" calcium reduces diastolic blood pressure by 8.2%, while 500 mg of calcium gluconate did not have an effect.

It also stated that another study with 1,000 mg of a mixed calcium carbonate/lactate/gluconate product reduced diastolic blood pressure by 9%. While this might make the "food-grown-type" calcium product seem to be superior because it produced almost as much effect as the calcium carbonate/lactate/gluconate mixture at half the dose, 500 mg of a "food-grown-type" calcium product costs the consumer approximately 3 times more and requires about 3 times as many tablets as the 1,000 mg calcium carbonate/lactate/gluconate supplement, while producing slightly less effect (9% versus 8.2%). Most commercially available "food-grown-type" products contain far less than 500 mg of calcium (generally not more than 50 mg per tablet).

Calcium Absorption Comparison

Regarding the question of absorption of "food-grown-type" calcium compared to USP-type calcium, the above study stated, *"The present study indicates that the ["food-grown-type" calcium at 500 mg] was more absorbed than the calcium gluconate, but the difference was not quite significant, due to the small number of subjects."*

"Not quite significant" is a specific scientific term that means that a study's results do not conclusively verify that there actually is any difference in absorption.

The study by Sheikh that is cited below, which was published in the peer-reviewed New England Journal of Medicine, showed that calcium gluconate absorbed at 27%, while calcium carbonate absorbed at 39%. Calcium carbonate was also noted as exhibiting somewhat superior absorption to calcium gluconate, and the difference was also *not considered to be "statistically significant."*

Sheikh MS, et al. Gastrointestinal absorption of calcium from milk and calcium salts. N Engl J Med (1987) Aug 27, 317(9): 532-536.

The lack of a *significant* difference in absorption between "food-grown-type" calcium and calcium gluconate in the Vinson study, and calcium carbonate's somewhat better, but also *non-significant difference* in absorption compared to calcium gluconate in the Sheikh study indicates that *there is probably no significant difference in absorption between "food-grown-type" calcium and calcium carbonate, because of their common relationship with calcium gluconate.*

Calcium carbonate requires only 2 medium-sized (1,350 mg) tablets to provide 1,000 mg of elemental calcium, while "food-grown-type" calcium requires about 16 tablets and costs the consumer 12 times more than calcium carbonate. In this regard, calcium carbonate appears to be a significantly better choice for use in dietary supplements.

My evaluation of how much "food-grown-type" calcium could be provided per tablet showed that "food-grown-type" calcium is typically provided in doses of 8 to 50 mg of elemental calcium per tablet, because the "food-grown-type" materials require so much physical space.

Therefore, it would take between 10 and 62 tablets to get the 500 mg dose used in this study.

Ten to 62 tablets per day equals between 2 and 8 bottles of 180 tablets (360 to 1440 tablets) per month of a "food-grown-type" product.

When this is considered, USP-type calcium carbonate or calcium citrate are more logical choices.

Additionally, while several independently published peer-reviewed studies confirm that an optimal 1,000 mg dose of calcium carbonate can increase bone density in senior women (See page 11, #5.) and 1,200 mg can improve bone density in newborn babies**,** (See page 6, Koo study of 256 pregnant women.), there are no published studies that show any effect on bone density in humans with "food-grown-type" calcium.

For those who would dismiss the idea that "food-grown-type" calcium might absorb equally to calcium carbonate because of an incorrect assumption that calcium carbonate does not absorb well, note that in 1999, calcium carbonate was conclusively shown to absorb equally to calcium citrate *when they are taken with food* by Dr. Robert Heaney, one of the most published calcium researchers. (Heaney RP, et al. Osteoporos Int, 9(1):19-23 1999.)

Studies Of Higher Doses Of Calcium Do Not Validate Low Doses

Important note: Studies that investigate 500 mg of "food-grown-type" calcium per day do not validate claims about the effectiveness of low doses (50 mg or 200 mg) of "food-grown-type" calcium.

Numerous scientific studies conclude that the effects produced by higher doses of nutrients may not occur at lower doses, especially very low doses.

Studies Verify The Need For Higher, Optimal Doses

Dozens of independent published studies on calcium and its potential to preserve or build bone show that supplemental daily doses beginning at 1,000 mg or more of elemental calcium are required for healthy bone maintenance and bone density for adult women and even newborn babies, regardless of the source of calcium, calcium citrate, calcium carbonate, or calcium gluconate.

One study of 256 pregnant women showed that they ate an average American diet that provided less than 600 mg of calcium per day, and took a calcium carbonate supplement that provided 1,200 to 2,000 mg per day, their babies were born with as much as 15% more bone density than those babies whose mothers did not supplement with 1,200 mg or more of calcium carbonate per day. (See: Koo WW, et al. Maternal calcium supplementation and fetal bone mineralization. Obstet Gynecol 1999 Oct;94(4):577-582.)

Since the highest dose of "food-grown-type" calcium available provides only 50 mg per tablet, it would likely take 24 tablets of "food-grown-type" calcium to provide the amount of calcium that can optimize the bone health of newborn babies.

Common Foods Contain More Calcium Than "Food-Grown-Type" Products

A cup of navy beans provides about 150 mg of calcium and a glass of milk provides approximately 100 mg of calcium.

The kinds of very low doses of nutrients that can be provided by "food-grown-type" materials can more easily be obtained from fresh whole food with supplemental USP-type calcium for considerably less cost.

Independent Studies Of Vitamin C Confirm That Effectiveness Generally Begins At About 1,000 mg Per Day

One study showed that senior women who took between 1,000 and 5,000 mg of pure, USP-type Vitamin C had about 5 percent better bone density over three years than women who took 500 mg or less per day. (Morton DJ, et al. Vitamin C supplement use and bone mineral density in postmenopausal women. J Bone Min Res 2001;16(1):135-140.)

A study from Harvard University showed that people who took 1,500 mg or more of pure, USP-type Vitamin C per day had about 21 percent less chance of developing kidney stones than people who took less than 500 mg per day (Gerster, H. No contribution of ascorbic acid to renal calcium oxalate stones. Ann Nutr Metab 1997;41(5):269-282.)

The Vitamin C study reviewed below investigated 500 mg and 2,000 mg of powdered "food-grown-type" Vitamin C compared to equal doses of pure USP-type Vitamin C. Typical "food-grown-type" multi-vitamin products only provide 25 to 250 mg of Vitamin C per tablet because of space limitations. USP-type Vitamin C is typically available at 1,000 mg per tablet.

Study #2: Vitamin C Absorption And Bio-Availability Comparison

A study that appeared in a peer-reviewed journal answered questions about the absorption and bioavailability of USP-type Vitamin C compared to "food-grown-type" Vitamin C, which is produced in a laboratory process that combines USP-type Vitamin C with citrus and other materials. This study was also conducted by the same single paid researcher and was funded by a "food-grown-type" nutrient manufacturer.

Vinson JA, et al. In-vitro and in-vivo reduction of erythrocyte sorbitol by ascorbic acid. Diabetes 1989 Aug;38(8):1036-1041.

In three separate tests, "food-grown-type" Vitamin C and USP-type Vitamin C (ascorbic acid) were compared for how well they were absorbed into red blood cells and for their effect on the reduction of a sugar alcohol called sorbitol inside red blood cells. One measure of the efficacy of Vitamin C at the cellular level is a reduction of sorbitol in red blood cells. Reduction of sorbitol indicates that a Vitamin C supplement is bioavailable and utilized.

Part 1: In part one of this study, "food-grown-type" Vitamin C and USP-type Vitamin C were given to healthy (non-diabetic) subjects at 500 mg. (Tables 1a and 1b)

Table 1a: Increase in Vitamin C Inside Red Blood Cells at 500 mg (non-diabetic subjects)

"Food-grown-type" Vitamin C	57.5% increase
USP-type Vitamin C (ascorbic acid)	35.5% increase
Result: "Food-grown-type" Vitamin C exhibited 22% better absorption	

Table 1b: Reduction in Red Blood Cell Sorbitol at 500 mg (non-diabetic subjects)

"Food-grown-type" Vitamin C	27.2% reduction
USP-type Vitamin C (ascorbic acid)	12.6% reduction
Result: "Food-grown-type" Vitamin C reduced sorbitol 14.6% more	

In the table above, at 500 mg, in healthy non-diabetic subjects, "food-grown-type" Vitamin C was better absorbed into red blood cells (22% more) and reduced sorbitol more effectively than USP-type Vitamin C (14.6% more). Since "food-grown-type" Vitamin C costs 10 times more (1,000%) and requires 4 times as many tablets (400%) as USP-type Vitamin C, ***these better measurements come at a considerable expense,*** so the reported superiority is not equitable. A review of other "food-grown-type" nutrient studies shows no significant difference in effect, or similar small effects, for relatively high costs.

Part 2: The second part of the study provided data on the effect of 2,000 mg of USP-type Vitamin C, also in healthy subjects, but did not provide data on "food-grown-type" Vitamin C. (Tables 2a and 2b)

Table 2a: Increase in Vitamin C Inside Red Blood Cells at 2,000 mg (non-diabetic subjects)

"Food-grown-type" Vitamin C	No data provided
USP-type ascorbic acid	291% increase

Table 2b: Reduction in Red Blood Cell Sorbitol at 2,000 mg (non-diabetic subjects)

"Food-grown-type" Vitamin C	No data provided
USP-type ascorbic acid	56.1% reduction

In Tables 2a and 2b, in non-diabetic subjects, USP-type Vitamin C at 2,000 mg (4 times 500 mg) increased red blood cell Vitamin C, not 4 times better, but 5 times better than "food-grown type" Vitamin C did at 500 mg. (291% at 2000 mg versus 57.5% at 500 mg. 291% ÷ 57.5% = 5)

Comment: This suggests that the relative absorption of USP-type Vitamin C in healthy non-diabetic subjects may be superior to "food-grown-type" Vitamin C as doses increase.

Part 3: In the third part of the study, the two forms of Vitamin C were given to diabetics, whose metabolisms are somewhat different than healthy individuals. (Tables 3a – b)

Table 3a: Increase in Vitamin C Inside Red Blood Cells at 2,000 mg (diabetic subjects)

"Food-grown-type" Vitamin C	58.8% increase
USP-type ascorbic acid	71.6% increase
Result: USP-type exhibited 12.8% better absorption	

Table 3b: Reduction in Red Blood Cell Sorbitol at 2,000 mg (diabetic subjects)

"Food-grown-type" Vitamin C	41.3% reduction
USP-type ascorbic acid	48% reduction
Result: USP-type reduced sorbitol 6.7% more	

At 2,000 mg, with diabetics, USP-type Vitamin C was 12.8% better absorbed into red blood cells and caused a 6.7% better reduction in sorbitol, while requiring 1/4th as many tablets and costing 1/10th as much as "food-grown-type" Vitamin C. When the dose increased to 2,000 mg, USP-type Vitamin C was superior.

Discussion And Summary Of The Vitamin C Study

1. Vitamin C as USP-type Vitamin C is 10 times less expensive to the consumer than "food-grown-type" Vitamin C.
2. "Food-grown-type" Vitamin C requires 4 times more physical space than pure USP-type Vitamin C, so it takes 4 tablets to equal the amount of Vitamin C contained in 1 tablet of USP-type Vitamin C. 2,000 mg of USP-type Vitamin C requires two 1,100 mg tablets, while 2,000 mg of "food-grown-type" Vitamin C requires 8 tablets.
3. The study's data did not show a consistent advantage in absorption or the bioavailable effect of reducing sorbitol for either form of Vitamin C at two difference doses. However, USP-type Vitamin C requires 1/4th as many tablets and cost 1/10th as much as "food-grown-type" Vitamin C, so USP-type Vitamin C provides a much better cost for benefit received to the customer.

Study #3: Comparative Antioxidant Study Of Two Forms Of Co-Q10

A concern about the use of "food-grown-type" Co-Q10 is that "food-grown-type" Co-Q10 costs the consumer over 13 times more than pure USP-type Co-Q10.

For this much difference in consumer cost, I require that there is solid scientific evidence verifying that the product is at least 13 times more effective than the USP-type version of the product. However, there are no human studies or independent published studies that support the claim that "food-grown-type" Co-Q10 is superior to USP-type Co-Q10. The only study available on "food-grown-type" Co-Q10 is a test-tube study that was funded by a manufacturer that has not been published in a medical journal.

A claim made about "food-grown-type" Co-Q10 in this study is that it has *"9.6 times more antioxidant activity than USP-type Co-Q10."* Another claim is that *"22 mg of "food-grown-type" Co-Q10 works better than 200 mg of USP-type Co-Q10." (A new claim being made is that it has 20 times more antioxidant activity than USP-type Co-Q10.)*

I investigated the study that is used to support these claims. Here is a review of this five-paragraph non-published, un-referenced test tube (in-vitro) study. (A copy of this study, by Joseph Vinson, Ph.D., was obtained by calling a "food-grown-type" nutrient vendor.)

Considerations and Concerns About The Co-Q10 Study

If the reported results of this non-published, un-referenced paper can be corroborated, this could be an extremely important nutritional breakthrough.

This test-tube (in-vitro) study does not include the specific results of the observations and data from the study, just notes from the undisclosed results that said that the antioxidant effects of "food-grown-type" Co-Q10 and USP-type Co-Q10 on LDL and VLDL cholesterol were calculated, with the final comment being that the "food-grown-type" Co-Q10 molecules were 9.6 times stronger as an anti-oxidant than USP-type Co-Q10.

It is of concern that while this study presents conclusions that go beyond the bounds of well-known biochemistry, none of the calculations to arrive at them are included, and this paper has never been published in the scientific literature. It is also of concern that the author did not formalize this study with references, especially since he refers to one of his previous studies, but doesn't reveal where to find the study.

Additionally, it is unclear how the type of anti-oxidant activities of Co-Q10 and its molecular functions can be increased 9.6 times.

For example, does the transfer of electrons associated with anti-oxidant activities proceed at 9.6 times the normal rate for the "food-grown-type" Co-Q10? Or is the "food-grown-type" Co-Q10 molecule somehow more rapidly "recharged" so that it can regenerate itself 9.6 times faster than USP-type Co-Q10 molecules?

Does the molecular function of "food-grown-type" Co-Q10 somehow change at the electron level because the molecule has been imbedded in the undefined "natural" "food-grown-type" matrix?

Is there some unknown substance in the "natural" "food-grown-type" matrix that inhibits the oxidative action of the pro-oxidant agent that was used to cause oxidation in the experiment, copper oxide, which would not inhibit oxidation caused by other pro-oxidants, like iron oxide? These are important, if preliminary, biochemical questions that need to be answered.

If this discovery is real, then it is a multi-billion dollar discovery. One logical concern: Why is it tucked away, seemingly casually written, and used only for marketing purposes?

This is significant because if there is some way that Co-Q10's anti-oxidant activity can be increased 9.6 times by manipulation of the molecule, then most probably, other nutritional molecules can be manipulated as well to increase anti-oxidant activity. This would be worthy of research not only in nutrients, but also for use in drugs.

If all "food-grown-type" nutrients demonstrate increased efficiency, why have the studies reporting these important findings only been done by one researcher paid by the "food-grown-type" companies?

Why has no other researcher, doctor or university published a study on "food-grown-type" nutrients that show these kinds of results in the twenty-plus years that "food-grown-type" nutrients have been available?

Part II of The Study: Stability of Two Forms of Co-Q10

In this part of the study, the two forms of Co-Q10 were put in beakers and exposed to air for three months. As expected, the Co-Q10 molecules surrounded by the "natural" food-matrix were exposed to less oxygen than the plain USP-type Co-Q10 molecules that were directly exposed to air. The food-matrix covered Co-Q10 molecules were not oxidized as much as the Co-Q10 molecules that were exposed directly to air without the protection of the "natural" food-matrix.

At the end of 3 months, the raw pure Co-Q10 molecules degraded (oxidized) 20.6% more than the "natural" food-matrix-covered protected Co-Q10 molecules.

Comment: This shows that if an anti-oxidant, like Co-Q10, is kept out of contact with air because it is surrounded by materials that insulate it from oxygen, it will not degrade (oxidize) as fast as if it were left out in the air. The results might have been similar for USP-type Co-Q10 if the UPS-type Co-Q10 had been embedded in another insulating matrix made of any common food, such as peanut butter.

It is not explained how this part of the study applies to what happens during the few hours after Co-Q10 is ingested by humans (orally).

Bottom Line Consumer Cost Considerations

"Food-grown-type" Co-Q10 typically costs $39.90 per bottle of 30 capsules with 22 mg per capsule. Thus, the consumer cost of "food-grown-type" Co-Q10 is $1.33 per 22 mg capsule, so it costs 5.13 cents per mg.

A commonly available USP-type Co-Q10 product (i.e. Jarrow Formulas Ultra Potent Co-Q10) costs 38 cents per 100 mg, so it costs 0.38 cents per mg, less than $1/13^{th}$ as much as "food-grown-type" CO-Q10. (0.38 = $1/13^{th}$ of 5.13.)

If It Really Is 9.6 Times More Effective

If "food-grown-type" Co-Q10 really is 9.6 times more effective than USP-type Co-Q10, it will take only 10.4 mg to get the equivalent of 100 mg of USP-type Co-Q10. (100 mg divided by 9.6 = 10.4 mg)

Then the equivalent cost to the customer for the 10.4 mg of "food-grown-type" Co-Q10 that would equal 100 mg of USP-type Co-Q10 would be 53 cents. (10.4 mg x 5.13 cents per mg = 53 cents.)

As noted above, the cost of a 100 mg capsule of USP-type Co-Q10 (i.e. Jarrow Formulas Ultra Potent Co-Q10) is 38 cents for a 100 mg capsule.

If “food-grown-type” Co-Q10 really is 9.6 times more effective than USP-type Co-Q10, then it takes 53 cents worth of “food-grown-type” Co-Q10 to get the equivalent effect of 38 cents worth of the USP-type Co-Q10.

This means that the USP-type Co-Q10 product costs 15 cents less to get the same effective dose. (53 cents minus 38 cents = 15 cents) In this scenario, the “food-grown-type” Co-Q10 is 39.4 percent more expensive than the USP-type Co-Q10. (0.38 divided by 0.15 = 39.4%)

If It Is Not 9.6 Times More Effective

If the “food-grown-type” Co-Q10 is really not 9.6 times more effective than regular USP-type Co-Q10, and the test-tube (in-vitro) Vinson study does not actually apply to real live humans (in-vivo), then “food-grown-type” Co-Q10 is 13½ times (1,350%) more expensive than USP-type Co-Q10. (5.13 cents per mg divided by 0.38 cents per mg = 13.5) If this is correct, “food-grown-type” CoQ10 also requires 13½ times more capsules to provide an equivalent effect.

No matter how it is calculated, “food-grown-type” Co-Q10 is far more expensive to the consumer than USP-type Co-Q10.

Consumer Cost Versus Proven Benefit Is A Consistent Concern

This is a consistent consideration with the use of “food-grown-type” nutrients when they are compared to USP-type nutrients. The higher costs of “food-grown-type” nutrients are not justified by published studies, and the small numbers of commercially sponsored studies conducted on “food-grown-type” nutrients do not provide solid scientific support for claims of superior absorption or effects in humans. Additionally, no studies have been published by independent researchers.

A cost for benefit analysis of independent studies of USP-type nutrients shows significant benefits that require far fewer tablets for far less cost than “food-grown-type” nutrients.

Optimal Dose-Related Effects of Nutrients Require Higher Dosage

While there are unfounded claims that the doses of typical USP-type nutrient dietary supplement formulas are “too high” and that “food-grown-type” nutrient formulas in very low doses are superior, over 22,000 independently published studies show the (higher) dose-dependent effect of nutrients. A specific threshold dose for the nutrient is necessary to produce an optimal effect, where a lower dose will not be effective. Such is the case with folic acid, an important nutrient for healthy childbirth.

Garcia-Morales MA et al. Peri-conception use of folic acid in the prevention of neural tube defect: current concepts. Ginecol Obstet Mex 1996 Sep;64:418-421.

Comment: This study stated that the incidence of birth defects (neural tube defects) is about 1.3 cases per 1,000 live births. *It also stated that doses of supplemental folic acid could reduce this birth defect by 40% at 400 mcg, and reduce it by 75% at 4,000 mcg. There was a clear higher dose-dependent effect on the reduction of birth defects.*

As the study on page 3 showed, USP-type folic acid in dietary supplements is absorbed about 40% better than folic acid from foods (in “food-form.”) See also: http://www.michaelmooney.net/nutrientabsorption.html

Note: Folic acid supplementation above 1,000 mcg per day should be accompanied by adequate Vitamin B12 supplementation. Pregnant women should consult their doctors about this.

A review of six of the thousands of studies that show a clear dose-dependent beneficial effect for USP-type nutrients. Appropriate doses provide optimal benefits.

1. **Premenstrual Syndrome:**
   A study of 630 women showed that while 40 mg of Vitamin B6 produced no significant benefit, 100 mg to 150 mg reduced PMS symptoms in about 66% of the women, while 160 mg to 200 mg of Vitamin B6 reduced PMS symptoms in about 79% of the women. (Brush MG, et al. Pyridoxine in the treatment of premenstrual syndrome: a retrospective survey in 630 patients. Brit J Clin Pract 1988;l42(11):448-4562.)

2. **Cardiovascular Health:**
   A study of 600 people that was presented at the American Heart Association 41st Annual Conference on Cardiovascular Disease Epidemiology and Prevention, March 8, 2001 (Dwyer, et al.) showed that doses of Vitamin E below 400 IU per day were not effective in maintaining artery wall health, while Vitamin E doses from 400 IU to 1,500 IU were beneficial.

3. **Healthy Arteries:**
   Another study showed that 400 IU, 800 IU and 1,200 IU of supplemental USP-type Vitamin E reduced cholesterol oxidation that can precede the formation of plaque in the arteries in a dose-dependent manner, while 60 IU and 200 IU did not produce an effect. (Jialal I, et al. The effect of alpha-tocopherol supplementation on LDL oxidation. A dose-response study. Arterioscler Thromb Vasc Biol 1995 Feb;15(2):190-198.)

4. **Bone Density:**
   As mentioned on page 6, a three-year study showed that women who took between 1,000 mg and 5,000 mg of supplemental USP-type Vitamin C per day had 5% greater spinal bone density than women who took 500 mg or less. (Morton DJ, et al. Vitamin C supplement use and bone mineral density in postmenopausal women. J Bone Miner Res (US), Jan 2001;16(1):135-40.)

5. **Bone Density:**
   A two-year placebo-controlled study of three groups of senior women showed that those who received 1,000 mg of supplemental USP-type calcium carbonate per day added to the 683 mg of food-calcium from their diet (total = 1,683 mg of calcium per day) ended the study with 4.8% greater bone density than women who received only 683 mg of food-calcium from their diet.

   The group that received only 683 mg of food calcium per day from their diet lost 3% of their greater bone density. The group that received 683 mg of food calcium per day from their diet plus four glasses of milk (total calcium intake 1028 mg) lost 1.5% of their greater bone density. But the group that received a total of 1,683 mg of daily calcium from their diet plus 1000 mg of calcium carbonate "*suffered no bone loss and gained a significant increase in spinal [3.7 percent] and femoral neck [3 percent] bone mineral density*". (Storm D, et al. Calcium supplementation prevents seasonal bone loss and changes in biochemical markers of bone turnover in elderly New England women: a randomized placebo-controlled trial. Clin Endocrinol Metab, 83(11):3817-25 1998.)

   The researchers said that <u>not having enough</u> calcium *"…was the strongest predictor of hip bone loss."*

6. **Bone Density and Reduced Risk of Fracture:**
   Another study of senior women *and* men, 65 or older, stated that lower calcium doses were not effective to reduce bone loss and reduce the risk of fracture, because they are *"…substantially lower than [calcium intake] that human physiology is adapted to by evolution."*

   "Supplemented intakes (of calcium) of 1300 to 1700 mg per day have been shown to arrest age-related bone loss and to reduce fracture risk in people 65 and older." The study also stated, *"Supplemental [calcium] intakes of 2400 mg per day can restore the setting of the parathyroid glands to young adult values."* (Heaney RP. Calcium needs of the elderly to reduce fracture risk. J Am Coll Nutr 2001 Apr;20(2 Suppl):192S-197S.)

   Improved parathyroid function to *"young adult values"* can reduce the loss of calcium from bone and bone loss, which reduces the rate of fractures and other health problems over the long term.

   This makes sense when it is considered that evolutionary studies by Eaton and Conner have indicated that humans are adapted by evolutionary need to obtain approximately 1,600 to 2,100 mg of calcium per day from food to stay healthy. This is approximately how much calcium we would get each day from foraging for food in the wild. (Eaton, et al. N Engl J Med 1985 Jan 31;312(5):283-289.)

Third Investigation: 2001

Committee For Product Label and Integrity Report
National Nutritional Foods Association (NNFA)

During my final investigation, I examined a 22-page 1989 NNFA-commissioned report on "food-grown-type" nutrient claims, entitled *"Preliminary Evaluation of Claims for 'Food Form' Nutrients."* In the report, Burton Kalman, Ph.D., the Director of Research for the National Nutritional Foods Association (NNFA), a non-profit

natural products industry trade organization, stated that the advertising claims made about protein carriers described in "food-grown-type" nutrient literature are not supported by science.

1. The report was commissioned because the NNFA Committee for Product and Label Integrity (COMPLI) had concerns *"regarding certain advertising claims of superior bioavailability of ["food-grown-type"] products…"*
2. Dr. Kalman wrote the 22-page report after he reviewed all the literature that was available, and spoke to a number of scientific researchers, including Dr. Joseph Vinson, the only researcher who continues to study "food-grown-type" nutrients.
3. Dr. Kalman referred to other studies of "food-grown-type" nutrients that were conducted by two other researchers noted on page 4, saying that their *"…results had been misused… through an improper method of calculating percentage differences." Dr. Kalman also stated that the doctors complained that the "interpretation of [their] work does not represent a true picture of [their] findings and I agree."*

Dr. Kalman summarized his conclusions,
"It is my conclusion that the claims for the superiority of these "food form" supplements are not supported by the data presented by the companies which sell them."

Protein Carriers For Nutrients Are Created In Intestinal Cells, Not Derived From Foods Or "Food-Grown-Type" Nutrients

After analyzing claims about protein carriers and absorption of "food-grown-type" nutrients, NNFA's report by Dr. Kalman said:

"There are frequent references in [the company's] literature to carrier proteins, the need for protein for absorption of nutrients and the significance of incomplete enzymatic digestion of protein in the gut prior to absorption. Carrier proteins are highly specific proteins, which are involved in the absorption of some nutrients. They are produced in the cells lining the intestinal tract; they are not derived from foods."

Upon reviewing Dr. Kalman's report, the NNFA committee issued an official NNFA report, in which it stated:

"It is the Committee's opinion that such current advertisements by firms promoting food-like supplements as …

"…absorbed up to 5 times more and retained up to 16 times more than ordinary vitamins."

and other claims of product uniqueness and superiority, such as,

"… proven 13 times better than any other Vitamin C…"

are not supportable statements and are not in the best interest of the health food industry.

We request these advertisements cease immediately until such time as they are properly substantiated."

This report was endorsed by National Nutritional Foods Association Board of Directors, July 13, 1989.

The NNFA report was located in the court case that dealt with claims being made about "food-grown-type" nutrients, that is referred to on page 2. (US District Court, Northern District of California, No. C-88-20496-SW).

In this court case, Dr. Joseph Vinson, the single researcher who continues to study "food-grown-type" nutrients, stated that he was not aware of any product, (including a "food-grown-type" nutrient product) which has a protein bound to a vitamin. (Plaintiff's Exhibit 7, Vinson Deposition 85:6-19.)

After all data had been reviewed, the U.S District Court stated that [vendors of "food-grown type" nutrients] *"…shall cease advertising, stating, publishing or in any way implying that any ["food-grown-type"] products contain vitamins bound to proteins, or that any ["food-grown-type" product] is in any way revolutionary, unique or chemically different as a result of claimed protein bonding…. This court has preliminarily determined there is no scientific basis to conclude that ["food-grown-type"] vitamins are bonded to proteins…"* This ruling was finalized on July 25, 1989, Exhibit D.

In Exhibit 2, dated July 27, 1989, the court also noted that advertisements were to "*…stop claiming that over 50 studies confirmed the superior absorption rates of the products…"*

Scientists Quoted In Promotional Literature Do Not Support Claims

In my final investigation, I also contacted the two scientists who have been quoted in "food-grown-type" promotional literature to find out more about their research.

Some "food-grown-type" promotional literature quotes from the works of these scientists to describe unique protein carriers in "food-grown-type" nutrients that are claimed to cause increased absorption and utilization of "food-grown-type" nutrients compared to USP-type nutrients.

The two scientists are the 1999 Nobel Prize winner in physiology and medicine, Dr. Gunter Blobel, who conducted groundbreaking work on protein transport mechanisms in the body, and molecular biologist Dr. Thomas O'Halloran, who conducts research on metallochaperone proteins. Some promotional materials state that claims about protein carriers *"have now been proven by the work of Dr. Blobel and Dr. O'Halloran."*

I contacted these scientists to get more information about their research with "food-grown-type" nutrients. Upon seeing promotional literature with references to their work as supporting "food-grown-type" nutrient claims, Dr. Blobel and Dr. O'Halloran each denied being involved with or doing any research related to or supporting "food-grown-type" nutrients. Below are their statements:

> *"I know nothing of this, and have not endorsed anything of the kind."*
>
> Dr. Thomas O'Halloran, Northwestern University, Evanston, Illinois
> March 30, 2001

> ***"** …statements about me in their promotional literature are utter nonsense and misleading."*
>
> *"My work on protein carriers has nothing to do with their products, and what they are saying about their products having protein chaperones is not supported by my work."*
>
> Dr. Gunter Blobel, Rockefeller University, Syracuse, New York.
> 1999 Nobel Prize Winner in Physiology and Medicine
> April 29, 2001

Instead of the work of these researchers supporting claims about "food-grown-type" nutrients, these scientist's statements removed a major support for promotional statements and raise even more questions about the integrity of claims being made about "food-grown-type" nutrients.

Summary And Conclusions Of My Analysis

1. "Food-grown-type" nutrients are not derived from foods. They are synthesized in laboratory processes using pure USP-type nutrients. In this regard they are produced through more steps of synthesis than pure USP-type nutrients.

2. No independent studies that investigate "food-grown-type" nutrients could be located. All available published studies were commercially sponsored studies, funded by "food-grown-type" raw materials manufacturers.

3. All available published studies that investigate "food-grown-type" nutrients have been conducted by one paid researcher.

4. Another paid researcher stated that his study results were being *"…manipulated for commercial purposes."* A U.S. Court ruled that this use was *"false advertising"* and that his studies could no longer be used in advertising.

5. The court also ordered the cessation of claims about protein bonding causing enhanced absorption.

6. An NNFA report found claims about enhanced absorption and superiority of "food-grown-type" nutrients and protein carriers *"not supportable"* and *"not in the best interest of the health food industry".*

7. Detailed analysis of the available studies strongly supports the idea that USP-type nutrients are equal in absorption and bioavailability to "food-grown-type" nutrients.

8. Studies of "food-grown-type" nutrient effectiveness frequently use doses that are significantly higher than those that can be provided in a small number of tablets. USP-type nutrients require significantly less tablets to provide an effective dose.

9. Two scientists, who are quoted in some "food-grown-type" nutrient promotional literature, stated that their names were being used without permission and their work is not associated with "food-grown-type" nutrients. A Nobel Prize winner stated that the use of his name was *"utter nonsense and misleading."*

USP-Type Nutrients Remain The Logical Choice

While there are no independent conclusive data available on "food-grown-type" nutrients, USP-type nutrients have been investigated in over 200,000 independent studies that provide conclusive data on their safety and effectiveness.

USP-type nutrients have also been taken safely on a daily basis by millions of people for over 60 years, with documented roles in supporting overall health.

Because of these considerations I continue to use pure UPS-type nutrients.

Evaluation of Nutrients

Is the form of nutrients as USP-type nutrient or "food-grown-type" nutrients acceptable for my personal use? I rate these forms of nutrients as acceptable, questionable, or not acceptable.	**Score** **USP-Type Nutrients**	**Score** **"Food-Grown-Type" Nutrients**
1. **Is it natural to the human body?** USP-type nutrients are natural to the human body. "Food-grown-type" nutrients are natural to the human body.	**Acceptable**	**Acceptable**
2. **Has it had a long history of safe use in humans?** USP-type nutrients have been used safely for over 70 years. "Food-grown-type" nutrients may cause yeast or other food allergies.	**Acceptable**	**Not Acceptable**
3. **Is it supported by science and/or traditional wisdom?** USP-type nutrients have support from over 200,000 studies. Claims for "food-grown-type" nutrients are not well supported by scientific studies that have been published in medical journals.	**Acceptable**	**Not Acceptable**
4. **Is it nutritionally effective?** Thousands of studies have shown that USP-type nutrients are nutritionally effective. No independent studies have confirmed that "food-grown-type" nutrients are effective.	**Acceptable**	**Questionable**
5. **Is it cost effective?** USP-type nutrients are cost effective. "Food-grown-type" nutrients cost 8 to 14 times more than USP-type nutrients.	**Acceptable**	**Not Acceptable**
6. **Is it in a concentrated enough form that we are able to give optimal levels in a reasonable amount of tablets?** USP-type nutrients are 100% concentrated. "Food-grown-type" nutrients are only 5% to 25% concentrated, so they require many times more tablets than USP-type nutrients to provide an equal dose.	**Acceptable**	**Not Acceptable**
USP-type nutrients are acceptable in every evaluation category. **"Food-grown-type" nutrients are unacceptable because of the much greater cost and number of tablets required and allergenicity. An absence of independent research after 20 years does not give me confidence in claims being made.**	**Acceptable**	**Not Acceptable**

VITAMIN SAFETY TABLE

Vitamin and Mineral Doses and Safety (For Most Adults)

NUTRIENT		Daily Value US Gov't Minimum Level For Health	NOAEL Inst of Med No Observed Adverse Effect Level	LOAEL Inst of Med Lowest Observed Adverse Effect Level	MTD Pharmacy Times Minimum Toxic Dose
Vitamin A	IU	5,000	10,000	21,600	25,000 - 50,000
Vitamin C (See p. 16)	MG	60	More than 1,000	None	2,000 - 5,000
Vitamin D	IU	400	2,400 (Inst of Med)	3,800 (Inst Med)	50,000
Vitamin E	IU	30	1,200	None	1,200
Vitamin K	MCG	80	30,000	None	None Given
Thiamine (Vit B1)	MG	1.5	50	None	300
Riboflavin (B2)	MG	1.7	200	None	1,000
Niacin (B3) SR = Slow Release	MG	20	500 250 SR	1,000 500 SR	1,000
Niacinamide (B3)	MG	20	1,500	3,000	None Given
Pyridoxine (B6)	MG	2	200	500	2,000
Folic acid	MCG	400	1,000	None	400,000
Vitamin (B12)	MCG	6	3,000	None	None Given
Biotin	MCG	300	2,500	None	50,000
Pantothenic acid (B5)	MG	10	1,000	None	10,000
Calcium	MG	1,200	Approx. 2,400	5,000 (Inst Med)	12,000
Phosphorus	MG	1,200	1,500	2,500	12,000
Iron	MG	18	65	100	100
Iodine	MCG	150	1,000	None	2000
Magnesium	MG	400	700	None	6,000
Zinc	MG	15	30	60 mg	500
Selenium	MCG	70	200	910	1,000
Copper	MG	2	9	None	100
Manganese	MG	2	10	None	None Given
Chromium (III)	MCG	120	1,000	None	None Given
Molybdenum	MCG	75	350	None	None Given
Beta-carotene	IU	None	41,666	None	None Given

DV (Daily Value): Previously was Recommended Daily Allowance. These dosages are the minimum amount necessary for good health as determined by the National Academy of Sciences, acting for the U.S. Government. As new nutritional research is conducted, scientists estimate that these doses may not be high enough to support optimal health in today's stressful world.

NOAEL: Meaning the "No Observed Adverse Effect Level." These dosages have been estimated by The Food and Nutrition Board of The Institute of Medicine (Inst of Med), National Academy of Sciences and are updated periodically. No observed adverse reactions (side effects) have been recorded at these levels.

LOAEL: Meaning the "Lowest Observed Adverse Effect Level." These dosages were determined by The Institute of Medicine to be safe for almost everyone, but *"may require the application of a safety factor to calculate safe intake"* for people with unusual vitamin or mineral sensitivities.

MTD's: Meaning the "Minimum Toxic Dose." These dosage levels were published in *Pharmacy Times Vitamin Safety Index,* May, 1985, as very conservative estimates of the minimum doses that may cause toxic effects (side effects).

As can be seen from the table, the levels of vitamins and minerals found in high potency multi-vitamins are not in the adverse effect or toxic ranges. They are also far lower than doses that have the potential to be lethal. (The U.S. Government Centers for Poison Control's first 10-year report showed no deaths from vitamins, 60 deaths from accidental iron poisoning, 2556 deaths from OTC drugs like aspirin, and over 1,000,000 deaths from prescription drugs.)

Minimum Toxic Dose (MTD) and Vitamin C Safety

The table on page 15 contains the most conservative data that is available regarding vitamin and mineral safety. I include all the data on the table to fully disclose what the most conservative scientific organizations have stated. However, to be clear, some data, such as the Minimum Toxic Dose for Vitamin C, have little solid support from published scientific literature.

The National Academy of Sciences finally established a No Observed Adverse Effect Level (NOAEL) for Vitamin C in July of 2000, because they were directed to establish one by the U.S. Government. They could not find any toxic dose for Vitamin C, so they arbitrarily placed an NOAEL with "*no solid data"* to validate it.

In the U.S. Government sponsored study shown below, long-time USDA nutrition scientist Dr. Carol Johnson stated, *"Currently, strong scientific data to define and defend a UL [tolerable upper limit] for Vitamin C is not available."* This is because Vitamin C has not been shown to cause toxicity to cells in the body, even at very high doses. (Note: UL equals the Tolerable Upper Limit, which is generally in the same dosage range as the NOAEL.)

In effect, this means that there is also no good scientific data to define and defend a Minimum Toxic Dose (MTD) for Vitamin C. In fact, when all the nutrients are evaluated and compared for safety, Vitamin C is among the nutrients that is the safest with the least potential for toxicity.

Johnston CS. Biomarkers for establishing a tolerable upper intake level for vitamin C. Nutr Rev 1999 Mar;57(3):71-77. Foods & Nutrition Laboratories, Arizona State Univ., Tempe, USA.

Dietary reference intakes (DRIs) for vitamin C for healthy U.S. populations are currently being formulated by the Panel on Dietary Antioxidants and Related Compounds of the Food and Nutrition Board of the Institute of Medicine. A major task of the Panel is to analyze the evidence of adverse effects of high-dose vitamin C intakes to derive, if appropriate, a Tolerable Upper Intake Level (UL) for vitamin C. The present report details current and past research examining potential adverse effects of supplemental vitamin C. The available data indicate that very high intakes of vitamin C (2 - 4 g/day) are well tolerated biologically in healthy mammalian systems. Currently, strong scientific evidence to define and defend a UL for vitamin C is not available.

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