

MISCONCEPTIONS ABOUT NUTRITIONAL SUPPLEMENTS AND MODERN DISEASES

Goran Nikolic¹, Dragana Markovic²

¹Faculty of Technology, University of Nis, Leskovac, Serbia

²Faculty of Sciences, Department of Chemistry, Nis, Serbia

Summary

It is very important to know all the requisite information on nutritional supplements before taking them. It is known that minerals and vitamins are necessary for optimal health. However, many of us just don't know what kind of minerals and vitamins to take which creates a lot of confusion, apathy, and frustration for a lot of people. Namely, numerous companies in the world are producing multi minerals and vitamins and promoting them as necessary for good health. But, at the same time are sabotaging the health of millions of people who are unsuspecting buyers of harmful and synthetic vitamins and minerals. The fact is that most mineral and vitamin brands on the market are synthetic, i.e. made from oxide minerals and other chemical substances. These products contain harmful substances, for example: preservatives, fillers, binders, coal tar, bitumen, gelatin, waste products etc. Consequently, these products cannot be digested by the human body and therefore cannot be assimilated. Moreover, they do not have a synergism due to being industrial-made and thus cannot find their way out of the body and thus get lodged in the tissues of the body causing disease or enhancing present diseases. Multi complexes are manufactured by pharmaceutical and food companies, and are not organic which is the state all digestible foods must be in for the body to break them down in order to absorb their nutrients. For those who are unsure, this article will provide some information to determine if vitamin tablets or multi mineral complexes are food or imitations.

Keywords: supplements, vitamins, minerals, diseases, nutrition.

Introduction

Nutritional supplements, and above all the vitamins and minerals, can be purchased today in supermarket or local drugstore, as well as at health food stores (Fig. 1). Whether the vitamins and minerals in the health food stores in some way better or were higher quality? Or it can be assumed that the ones in the supermarket or drugstore just as good? More than 95% of the vitamins, minerals and antioxidants that you can buy at "health food" stores and close to 100% of those sold in other stores are now made by the same few pharmaceutical and chemical companies who supply them to most all the vitamin and mineral companies. They are no longer the nutritional supplements they once were but are, more accurately, "nutraceuticals". In such a way, the drug companies are quiet taken over

the nutrition business. Thus, for example, people tend to assume that vitamin C from one brand is pretty much the same as vitamin C from another brand. And in many cases they're right since the vitamin C came from the same original supplier. But what most people do not realize is that these vitamins and minerals are not true and complete vitamins and minerals as would be supplied by good organically-grown whole foods. In fact, they are chemical synthetics made from such things as coal tar, petroleum products, animal by-products, ground rocks, stones, shells and metal (Thiel, 2014; Hui, 1992). And not only do they not supply the benefits of the real vitamins and minerals but they can actually be quite harmful when taken over time (Chong, 2005). Especially in the mega doses so often recommended. Real vitamins only require very minute doses to be effective. Do you sometimes ask yourself, how

many people suffer from rickets or scurvy? Probably none. What about cancer, heart disease, high cholesterol and diabetes? Probably a lot.

The latter are all diseases that arise from having too much! Multi-vitamin won't help much there.



Figure 1. The vitamins & supplements department at a foods market (<http://zoolies.us/natural-food-market>. Retrieved: October 2014)

For a long time, public media present us daily interesting marketing propaganda in the field of health and nutrition. There are some rather disturbing marketing trends that are geared towards human health and their diet. Namely, print and television advertisements show athletes, pretty girls and attractive women while nibbling candy bar that has been fortified with a bunch of synthetic vitamins and minerals, as well as a whole host of other artificial additives and preservatives. Smiling children have fortified juices, cereal bars, and even gummy candies and chewing gum. What these ad campaigns don't show is how these products are obtained and how they are processed that foods may contain harmful ingredients like hydrogenated oils, synthetic vitamins, and neurotoxins. Specific nutrients that are shown to be beneficial in clinical studies are isolated, often in synthetic form, and heralded as new weapon against cancer, heart disease, old age, etc (Pietrzik, 1996). Even in the field of alternative health we find this same sort of reductionism going on. Herbal compounds are isolated, extracted and ingested in inappropriate quantities, without the synergy that the whole plant provides. However, there is something to be said for using plants, their fruits, and foods in their whole forms and for cultivating a relationship with the different energies offered by the natural products around us. It's very hard

to improve on a diet of wild foods and herbs. Well-nourished bodies and minds enjoy balanced hormones and hearty immune systems. Daily input of nourishing products, such as fruits and vegetables, are a wonderful way to add extra nutrients to your diet. Unlike synthetic pills, natural products provide essential nutrients in a highly assimilable form.

Real or synthetic

Multivitamins are good for preventing conditions that arise from severe deficiency, but their helpfulness seems to taper off pretty quickly when the body is in a high calorie, insulin-rich physiological state that most people with a western diet find themselves in (Pietrzik, 1996). This isn't meant to demonize them, but to help people understand that taking one doesn't help the body exert the metabolic control needed to prevent diseases of convenience. Namely, Americans are spending more than \$17 billion a year on supplements for health and wellness. Strangely enough, the rates of some forms of chronic disease have not changed, while the rates of others have actually increased. There are a number of reasons for these poor statistics and many things remain a mystery. One thing seems fairly clear, however. Most supplements aren't helping very much (Chong, 2005). An article

suggests that individuals frequently exceed safe nutrient levels when they take vitamin supplements (Troppman et al., 2002).

The truth behind whole-food supplements

Namely, whole food supplements are what their name suggests. Supplements made from concentrated whole foods (Fig. 2). The vitamins found within these supplements are not isolated.

They are highly complex structures that combine a variety of enzymes, coenzymes, antioxidants, trace elements, activators and many other unknown or undiscovered factors all working together synergistically, to enable this vitamin complex to do its job in your body. Nutrients from within this complex cannot be taken apart or isolated from the whole, and then be expected to do the same job in the body as the whole complex is designed to do.

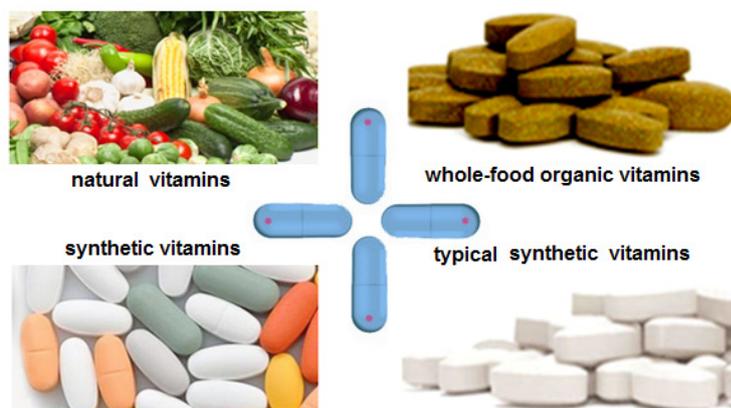


Figure 2. The whole-food vitamins product compared to a traditional synthetic brand (<http://blog.healthkismet.com/vitamins>. Retrieved: October 2014)

The perfect example of this difference can be understood on the example of an automobile (Chong, 2005). An automobile is a wonderfully designed complex machine that needs all of its parts to be present and in place to function properly. Wheels are certainly an important part of the whole, but you could never isolate them from the rest of the car, call them a car or expect them to function like a car. They need the engine, body and everything else. The same analogy applies to the vitamin C (ascorbic acid) or vitamin E (delta tocopherol) you can find on

most health food store shelves. They are parts of an entire complex that serve a purpose when part of the whole (Fig. 3). However, they cannot do the job of the entire complex by themselves. With similar logic in place, one can analyze what a typical multivitamin truly is. The automobile equivalent of creating a multivitamin would be going to a junk yard, finding all of the separate parts you would need to make up an entire automobile, throwing them together in a heap (or capsule in terms of the multivitamin) and expecting that heap to drive like a car.



Figure 3. Typical example of analogy between functioning a car engine and organic vitamin C (<http://www.advancedhealth07.com/nutrition>. Retrieved: June 2014)

Isolated nutrients or synthetic nutrients are not natural, in that they are never found by themselves in nature. Taking these isolated nutrients, especially at the ultra-high doses found in formulas today, is more like taking a drug. Studies show the body treats these isolated and synthetic nutrients like xenobiotics (foreign substances). By the same token, food-based supplements are never treated like this by your body. For example, your urine will never turn fluorescent yellow, no matter how much meat (a good source of B vitamins) you eat. This sort of rapid excretion happens only with foreign substances in your body. Not only are isolated nutrients treated like drugs or other chemicals by your body. Like drugs, they can create problems for you too. Nature does not produce any nutrient in an isolated form. The nutrients in foods are blended together in a specific way and work best in that format. For an isolated nutrient to work properly in the body, it needs all the other parts that are naturally present in the food too. If the parts are not all there from the start, they are taken from the body's stored supply. This is why isolated nutrients often work for a little while, then seem to stop working. Once your body's store of the extra nutrients is used up, the isolated nutrient you're taking doesn't work as well anymore. Worse yet, a deficiency in these extra nutrients can be created in your body. And, because most nutrients are isolated from the foods they come in - using a wide array of potentially nasty solvents and other chemicals - taking high amounts of these products can also expose you to these potentially toxic chemicals, if care is not taken to remove them. With the burden we are already facing from the high number of chemicals in our environment, why would anyone want to add more?

The various parts of a natural vitamin complex work together in a synergistic manner. Synergy means that the whole is greater than the sum of its parts. Nutritionist Judith De Cava (1997) puts it best: "Separating the group of compounds (in a vitamin complex) converts it from a physiological, biochemical, active micronutrient into a disabled, debilitated chemical of little or no value to living cells. The synergy is gone." In other words, the automobile, in its original form, will drive better than a pile of its individual parts. Most people don't follow this logic when examining a nutritional

supplement. Supplement makers typically try to stuff as much as possible in a capsule, telling us that the more we take, the better it is for us. This is simply not the case. As you now know, it is not necessarily the amount of a nutrient you ingest that is important, but its form and how much is bioavailable that counts the most. In fact, remembering that ingesting single nutrients can actually create imbalances in the body, logic would dictate the higher the level of a single nutrient that you take in, the quicker this imbalance will occur. What all of this means: The potency of a supplement has much more to do with synergy than with actual nutrient levels. It is a combined effect of all the parts of the food, rather than the chemical effect of a single part, that is most important.

Whole-food or synthetic supplements

In the previous chapter was already discussed the importance of taking natural supplements to support body and immune system. But which supplements do you take, and how do you know which supplements are the best ones? For example, Americans spend billions of dollars every year on supplements, and it's very important to understand that not all supplements are created equal. Sometimes, there are vast differences between products. What is the difference between whole food supplements and synthetic supplements (isolated or fractionated supplements)? A great example would be just to simplify look at almost any multivitamin. When you scan the nutritional content fact and ingredient label, you'll see quite an assortment of vitamins (A, C, E, etc.). Here is a portion of a label for a common multivitamin-multimineral supplement (Table 1). For this product say that replaces key nutrients that may be depleted through the stress of intense physical activity. Maximum formula with key ingredients (important vitamins and minerals) to keep you healthy and energized: physical energy (Cr, Fe, biotin, vitamins B₆ and B₁₂), mental energy (vitamins B₆ and B₁₂, thiamin, riboflavin, niacin), natural defense and immunity (Se, Zn, vitamins C and A), stress of physical activity (Se, vitamins A, C, and E), joints and bones (Ca, Mg, Zn, vitamins A, C, and D). However, although this product manufactured in USA, the statement has not been

evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat,

cure, or prevent any disease.

Table 1. Example of a multivitamin/multimineral supplement with amount per tablet and ingredient label (<http://www.naturemade.com/multivitamins>)

Vitamin	Value	Daily	Component	Value	Daily
A (as beta-Carotene)	4000 IU	50 %	Thiamin (as Thiamin mononitrate)	1.5 mg	88 %
C (as Ascorbic acid)	100 mg	167 %	Riboflavin	1.7 mg	85 %
D3 (as Cholecalciferol)	400 IU	100 %	Niacin (as Niacinamide)	18 mg	90 %
E (as dl-alpha-Tocopheryl acetate)	11 IU	37 %	Folic acid	800 µg	100 %
B6 (as Pyridoxine HCl)	2.6 mg	104 %	Calcium (as CaCO ₃)	250 mg	19 %
B12 (as Cyanocobalamin)	4 µg	50 %	Iron (as Ferrous fumarate)	27 mg	150 %
Ingredients Ca ₃ (PO ₄) ₂ , CaHPO ₄ , MgO, KCl, CaCO ₃ , ZnO, MnSO ₄ , CuSO ₄ , SiO ₂ , TiO ₂ , Na ₂ B ₄ O ₇ , NaVO ₃ , KI, Na ₂ O ₄ Se, NiSO ₄ , SnCl ₂ , Na ₂ MoO ₄ , CrCl ₃ , Na ₂ SiO ₃ . Ascorbic acid, dl-alpha-Tocopheryl acetate, beta-Carotene, Vitamin A acetate, Niacinamide, Riboflavin, D-Calcium pantothenate, Pyridoxine hydrochloride, Thiamine mononitrate, Folic acid, Phytonadione, Biotin, Ergocalciferol, Cyanocobalamin, Ferrous fumarate, Acacia. Glucose, Cellulose, Dextrin, Dextrose, Hypromellose, Corn starch, Croscarmellose sodium, Gelatin, Magnesium stearate, Stearic acid, Lecithin, Crospovidone, Polyethylene glycol, FD&C Red No. 40 lake, FD&C Blue No. 2 lake.					

Namely, there are a lot of vitamins listed on this label (Table 1). Look at the items listed under “Ingredients”. Those are “isolated” vitamins and other chemicals. There are no foods or herbal ingredients listed only partial vitamins and other chemicals. Nature intended for us to consume food in its whole form because all the vitamins, minerals, antioxidants and enzymes are bound together in one package and work synergistically to deliver the nutrition your body needs. Synthetic supplements give isolated or fractionated pieces of the whole. It is simply not the same, you’re not getting the full benefit nature intended. The other problem is, by taking isolated vitamins, sometimes we are getting massive doses of some vitamins, but not enough of others. This imbalance this can cause health problems too. Aren’t we trying to get healthier – rather than cause more problems?

Multivitamin and mineral supplements

Vitamins and minerals, and also enzymes, work closely together as co-factors for each other’s efficacy (Grujić et al., 2014). If one part is missing, or in the wrong form or the wrong amount, entire chains of metabolic processes will not proceed normally. Vitamins and minerals are not functionally separable. They make each other work. Example: vitamin D is necessary for the body to absorb calcium. Copper is necessary for vitamin C activity. And so on. Mineral deficiencies can cause vitamin deficiencies, and vice versa. So that is the other prime difference between whole food vitamins and synthetics: whole food vitamins contain within them many essential trace minerals necessary for their synergistic operation. Synthetic vitamins contain no trace minerals, relying on, and depleting, the body’s own mineral reserves.



Figure 4. Nutritional and synthetic supplements in a variety of dosage forms (<http://marchildebrand.com/nutrition/>; <https://www.goodchinow.com/supplements/>)

Significance of natural minerals

Minerals must come from land, respectively natural foods (fruits, vegetables, plants, seeds, nuts, grains). Minerals derived from natural and living substances such as food *supra* are organic. Minerals derived from non-living sources, i.e. metallic substances or synthetic metal salts are inorganic, i.e. non-living (Fig. 5). Most people are unwisely and unknowingly consuming inorganic minerals and vitamins by multi mixture products today. When using minerals for yourself you must know what to look for. A good mineral brand will list all organic sources of the minerals. These organic sources should be derived from food (fruit, plant, vegetable sources) exclusively. Any brand that lists any of the 102 minerals with a term following the mineral is synthetic. For example, nature made calcium, but not calcium gluconate. Nature made iron, but not iron ferrous. Nature did make oxide minerals, but not for purposes of human consumption. You

must remember that nature has produced two states of every mineral: organic and inorganic, or phosphate and oxide. Humans require organic or phosphate minerals. Also, nature does not give us anything mono-structured. A mono-structured element or mineral by itself or isolated (from other elements) is unstable and will sabotage your health before ultimately killing you. For example, as humans, we need and require oxygen, but oxygen by itself and not balanced with nitrogen is a poison. Therefore, nature balanced oxygen with nitrogen. Similarly, water is required for life, but nature balanced the water with hydrogen and oxygen. Water like the air (oxygen) we breathe is balanced. Therefore, your minerals and vitamins must also be balanced. The land can convert inorganic elements (minerals) into organic elements by humic acid. Humic acid improves the absorption of all vitamins and minerals, especially those derived from organic sources.

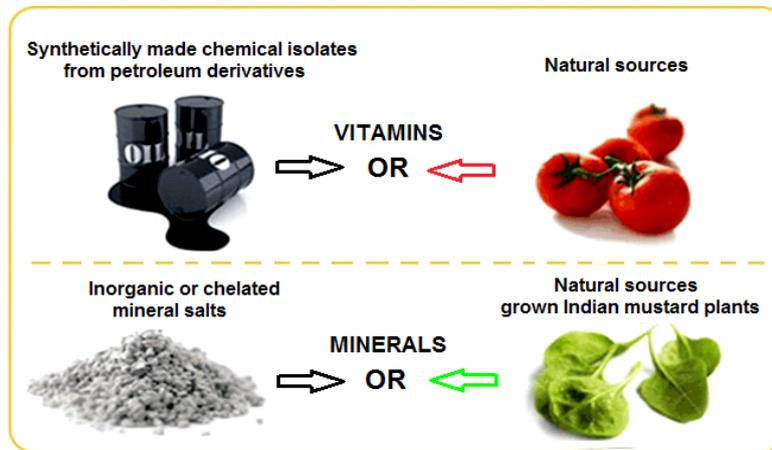


Figure 5. The origin of the vitamins and minerals that are part of the supplements (<http://mymannapages.com>. Retrieved: June 2014)

Calcium is one of the most common supplements. Researchers have managed to finagle a study that even shows calcium supplements aren't useful for boosting the bone density of elderly patients. People are being told that calcium is absolutely worthless if you don't digest it and absorb it. Calcium needs to have an acidic environment in order to be broken down and assimilated by digestive system. If you don't have acid in your stomach, then you can't absorb the calcium. And if you don't have vitamin D in small intestine, you

can't absorb the calcium, either. There are a lot of senior citizens out there who are spending small fortunes on calcium supplements and antacid tablets, but they're not getting any sunshine. And that means they're not getting enough vitamin D. With a vitamin D deficiency, they can't even absorb the calcium. It's either going right through their bodies or actually contributing to the buildup of calcification in their kidneys. They'll probably end up with kidney stones.

Significance of food-based vitamins

It is known that a good diet should supply all necessary nutrients. However, the true story builds a much more complex picture. Namely, even natural sources of vitamin A in unnatural quantities produce problems for species with particularly high susceptibility to vitamin A toxicity, like metabolic osteopathy (Polizopoulou et al., 2005). For precursors to vitamin A, the carotenoids, as many as nine factors influence their bioavailability when ingested in food (Van het Hof et al., 2000). The carotenoid lycopene, which lowers prostate cancer risk, illustrates the integrity of the plant substrate when carotenoids are ingested in food. Cooking improves lycopene bioavailability because heating and homogenizing lycopene-rich tomatoes into paste disrupts the fibrous plant cell walls, releasing the lycopene for. Partnering carotenoids with certain fats maximizes their intestinal and lymphatic uptake. Humans eating salads with either fat-free or full-fat dressing demonstrated significantly different plasma levels, with those ingesting vegetables dressed in the full-fat version enjoying higher amounts of circulating carotenoids (Brown et al., 2004).

Members of the water-soluble vitamin B class have a reputation of being safe in any amount. Nutritionists have long-advocated vitamin B9, or folate, for cancer prevention. However, a concern erupted in the 1940s that is now receiving more attention: Too much supplementation with folic acid (the synthetic form of folate) appears to promote tumorigenesis. This springs from its role as a key cofactor in nucleotide synthesis. Large amounts of folic acid facilitate cellular proliferation, causing growth in neoplastic foci. This finding has provoked calls in the human food-processing industry for curtailing mandatory folic acid fortification (Mason, 2009). The lower amounts of folate ordinarily found in food are still viewed as cancer-preventive.

Many nonhuman species manufacture vitamin C. While they rely less on dietary sources, research testing their true capacity shows it falls far short of previous assumptions. Aging hepatocytes lose some ability to synthesize and recycle vitamin C, producing a conditionally essential status for

vitamin C in geriatric dogs and cats. Health status may further influence vitamin C requirements. A study showed that healthy dogs supplemented with vitamin C produced no improvement in antioxidative capacity or serum IgA and IgG concentrations (Hesta et al., 2009). In contrast, dogs with untreated lymphoma exhibited significant alterations in their antioxidant levels compared to healthy control dogs. After remission, dogs with lymphoma had significantly lower levels of vitamin C, raising questions about the potential need for post-chemotherapy supplementation with dietary antioxidants. Finally, Vitamin C supplementation, along with vitamins B and E, aminocaproic acid and N-acetylcysteine, disappointingly failed to forestall deterioration in the neurological status of dogs with suspected degenerative myelopathy (Hesta et al., 2009).

In the wild, carnivores obtain vitamin D by consuming the body fat, blood and liver of their prey; depending on the contents of homemade diets, dogs and cats may not be receiving enough vitamin D (How et al., 1994). They cannot meet their needs simply through sun exposure, as dogs and cats lack the ability to cutaneously synthesize D3 in adequate amounts. Problems such as “rubber jaw syndrome,” or secondary hyperparathyroidism, have arisen in young dogs. On the other hand, overnutrition with supplemented Vitamin D, calcium, and calories in puppy diets has been linked to predisposition for canine elbow dysplasia (Janutta et al., 2008). The situation is similar with the vitamin E. On a supplement label, natural vitamin E is listed as d-alpha-tocopherol, d-alpha tocopheryl acetate, or d-alpha tocopheryl succinate. In contrast, synthetic forms of vitamin E are labeled with a dl- prefix. There is little difference between the natural and a synthetic form of vitamin E, but natural is better (Challem, 2000). Natural vitamin E refers to eight chemically different compounds obtained from plants: four tocopherols and four trienols (Fig. 6). Alpha-tocopherol is the most biologically active form of vitamin E, and its natural form consists of one isomer. In contrast, synthetic vitamin E (i.e. synthetic alpha-tocopherol) consists of eight stereoisomeric forms of alpha-tocopherol, with only one (about 12 %

of the synthetic molecule) equal to the naturally occurring stereoisomeric form (Yu et al., 2008). The other seven isomers range in potency from 21 to 90 % of natural d-alpha-tocopherol. This may appear to be arcane nutritional chemistry, but it is key to understanding how the body absorbs natural and synthetic supplements

differently. Molecular structure determines how the body uses vitamin E. Researchers have found that natural vitamin E assimilates far better than synthetic versions. Specific binding and transport proteins produced in the liver select the natural d-alpha form of vitamin E and largely ignore all other forms (Traber, 1998).

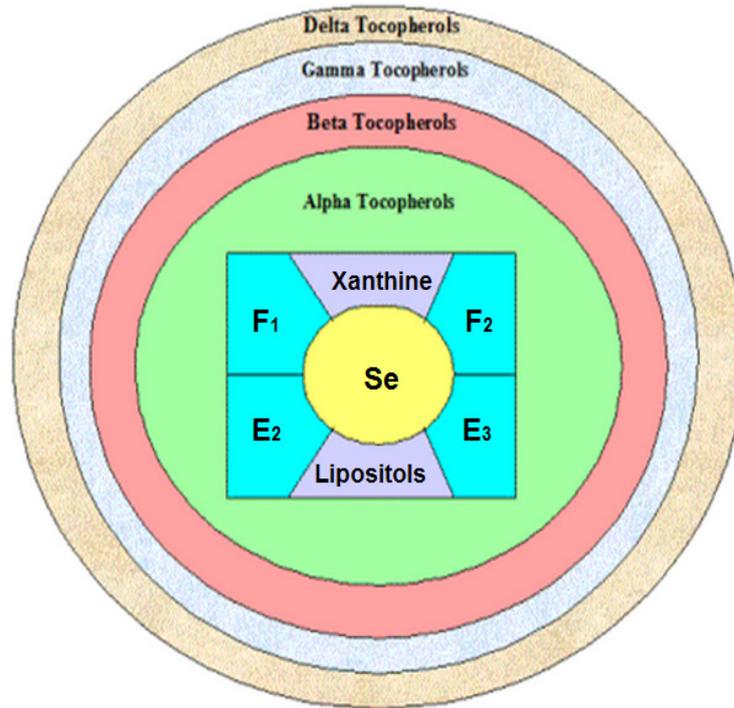


Figure 6. Functional architecture of vitamin E complex
(<http://alternativehealthatlanta.com/vitamins-minerals>. Retrieved: June 2014)

Generally, the health-supporting and cancer-preventive superiority of either natural or synthetic vitamin E remains unclear (Blatt et al., 2004). Studies exploring species-specific differences have further muddied the waters, with some indicating better results with the synthetic and others with the natural form (Weiss et al., 2009). Attention is turning to the formerly neglected half of the natural vitamin E family, the tocotrienols. Tocotrienols confer neuroprotective benefits and possibly more antioxidant properties than alpha-tocopherol. Tocotrienols distribute more widely throughout the fatty layers of cell membranes and tocotrienol, not tocopherol, suppressed growth of human breast cancer cells (Sen et al., 2007). Clearly, questions remain about when and how much vitamin supplementations small animals require, and whether or not pet food diets can meet their needs. However, veterinarians can

convey to clients facts based on the information that is available, fulfilling their role of protecting animal health and welfare.

Problem of synthetic vitamins

What occurs with all synthetic vitamins? If a person has in body enough reserves of the missing parts of a particular vitamin when combined with the vitamin isolate from the synthetic they will experience some initial relief. But as soon as those reserves are used up, the synthetic will no longer work, the symptoms will return and the person will now experience the often unpleasant effects of vitamin imbalance and deficiency. The body treats them as toxins, leading to the “expensive urine” of excess vitamin intake referred to frequently, since the human system via the urinary tract attempts to rid itself of the major

quantity of such foreign chemicals (De Cava, 1997). De Cava points out that vitamin B1, as synthetic thiamine (thiamine HCl) will initially allay fatigue but will eventually cause fatigue by the buildup of pyruvic acid. This leads to the vicious cycle of thinking more and more Thiamine is needed, resulting in more and more fatigue along with other accumulated complaints. Also, natural food-source vitamins are enzymatically alive, and man-made synthetic vitamins are dead chemicals. True whole food vitamins don't leech the body of their missing co-factors and don't cause a vitamin imbalance leading to the return and increase of symptoms. True vitamins also don't need mega doses to create their effect. A high number of milligrams is often an indication of a synthetic source.

A study in the of some 30,000 Finnish subjects showed conclusively that synthetic vitamin A had no antioxidant effect whatsoever (NEJM study group, 1994). A true antioxidant helps to protect heart muscle, lungs, and artery surfaces from breaking down prematurely. In this study, the subjects who received the synthetic beta-carotene actually had an 8% higher incidence of fatal heart attacks, strokes, and lung cancer than those who got the placebo (sugar pill). Stands to reason: the synthetic brought no vitamin activity to the tissues that needed it. As a dead, purified chemical introduced into the body, the synthetic further stressed the immune system, the liver, and the kidneys which all had to try to break down this odd chemical and remove it from the body. It would be bad enough if they were harmless, but synthetic vitamins actually have a net negative effect.

Identification of synthetic vitamins

Step 1. Search for words listed in the ingredients that begin with "dl." When a word contains "dl" in the prefix, it is an indication that the vitamin is synthetic. As an example, "dl-alpha-tocopherol acetate" and "dl-alpha-tocopherol" are synthetic forms of vitamin E.

Step 2. Find words that end with "ate" or "ide" in the list of ingredients. These words indicate that the manufacturer used synthetic materials for increasing the vitamin's potency and stability. Some words to look for include nitrate, acetate, sodium ascorbate, sodium benzoate, chloride, hydrochloride, silicon

dioxide and titanium dioxide.

Step 3. Find the synthetic form of the vitamin listed under the ingredient list. Natural vitamins come from natural food sources. If you see the vitamin listed as the vitamin itself, such as "vitamin D," then it is sure to be the synthetic version. Look for food sources such as "citrus" instead of "vitamin C" or "parsley" instead of "vitamin K."

Step 4. Identify the words "natural" on the vitamin bottle. If the bottle says, "100 percent natural" the vitamin supplement does not contain synthetics. On the other hand, a label that says, "natural," might have at least some synthetic components. According to Earl Mindell's, only 10 % of the product must come from natural food sources in order for a company to claim "natural" on the product's label. If the product label does not say "100 percent animal-based" or "100 percent plant-based," the supplement is synthetic.

Step 5. Look for the vitamin potency listed on the product's label. According to the Organic Consumers Association, if the vitamin supplement has a high or otherwise unnatural potency, the product is synthetic. For example, a product that provides 1,000 percent of vitamin C is unusually high. This is ten times the amount you need daily, and an amount that even a healthy diet - consisting of natural, whole-food sources - cannot provide.

Labels. The new nutritional disclosure labels actually make it more difficult to determine what healthy ingredients are and what are not (Fig. 7). The old labels (still on many products), tell you more about what is really in the product. As a general rule of thumb, vitamins listed in the ingredient section of the label, it is synthetic or fractionated, otherwise it would be listed as the food. Now on the new labeling, you have to look under the "Nutrition facts" section as well (where it lists what percentage of the daily value of basic nutrients is contained in the product). Where the vitamins are listed, look where it displays parenthesis (for example: vitamin A (as beta-carotene)". The word "as" generally denotes a synthetic or fractionated source, unless it sounds like a food. The ingredient label (since it is supposed to be food that you are eating) should sound like a food. So instead of the label saying, for example, "vitamin C (as ascorbic acid)", it should say "vitamin C (from acerola cherries)".

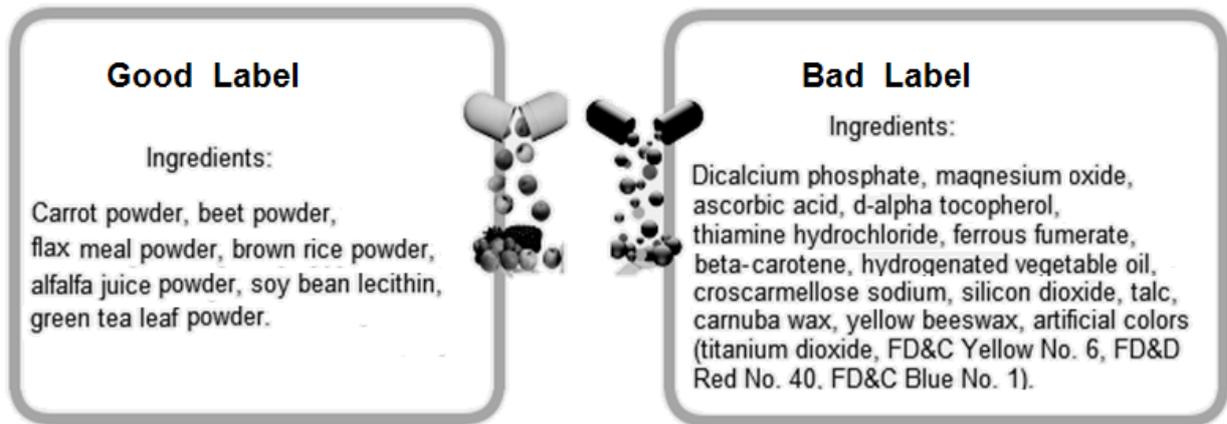


Figure 7. Samples of good and bad label for ingredients section
 (<http://www.vitalhealthcda.com/whole-food-supplements>. Retrieved: June 2014)

Synthetic and isolated nutritional supplements

According to science, vitamins are organic substances that are essential in small amounts for the health, growth, reproduction, and maintenance of one or more animal species. Vitamins must be included in the diet since they cannot be synthesized at all or in sufficient quantity in the body. Each vitamin performs a specific function; hence one cannot replace another. Vitamins originate primarily in plant tissues. Isolated non-food vitamins (call. natural or USP or pharmaceutical

grade) are not naturally “included in the diet”, do not necessarily “originate primarily in plant tissues”, and cannot fully replace all natural vitamin activities (Ensminger, 1994). Synthetic vitamins were originally developed because they cost less. Most vitamins in supplements are petroleum extracts, coal tar derivatives, and chemically processed sugar (plus sometimes industrially processed fish oils), with other acids and industrial chemicals (such as formaldehyde) used to process them (Table 2).

Table 2. Composition of food and non-food vitamins (Hui, 1992; Thiel, 2014)

Vitamin	Food nutrient	Natural vitamin analogue and some process chemicals
Vitamin A Beta-carotene	Carrots	Methanol, benzene, petroleum esters; acetylene; refined oils
Vitamin B-1	Nutritional yeast, rice bran	Coal tar derivatives, hydrochloric acid; acetonitrile with ammonia
Vitamin B-2	Nutritional yeast, rice bran	Synthetically produced with 2N acetic acid
Vitamin B-3	Nutritional yeast, rice bran	Coal tar derivatives, 3-cyanopyridine; ammonia and acid
Vitamin B-5	Nutritional yeast, rice bran	Condensing isobutyraldehyde with formaldehyde
Vitamin B-6	Nutritional yeast, rice bran	Petroleum ester & hydrochloric acid with formaldehyde
Vitamin B-8	Rice	Phytin hydrolyzed with calcium hydroxide and sulfuric acid
Vitamin B-9	Broccoli, rice bran	Processed with petroleum derivatives and acids; acetylene
Vitamin B-12	Nutritional yeast	Cobalamins reacted with cyanide
Vitamin 'B-x'	PABA Nutritional yeast	Coal tar oxidized with nitric acid (from ammonia)
Choline	Nutritional yeast, rice bran	Ethylene and ammonia with HCl or tartaric acid
Vitamin C	Acerola cherries, citrus fruits	Hydrogenated sugar processed with acetone
Vitamin D	Nutritional yeast	Irradiated animal fat/cattle brains or solvently extracted
Vitamin E	Rice, vegetable oils	Trimethylhydroquinone with isophytol; refined oils
Vitamin H	Nutritional yeast, rice bran	Biosynthetically produced
Vitamin K	Cabbage	Coal tar derivative; produced with p-allelic-nickel

Non-food vitamins should be considered as vitamin analogues (artificial imitations), and not as true vitamins for humans. One of the best ways to recognize whether or not a vitamin supplement contains natural vitamins as found

in food is to know the chemical differences between food and non-food vitamins (sometimes called USP vitamins). As shown in Table 3, the chemical forms of food and synthetic nutrients are normally different.

Table 3. Chemical form of food and non-food vitamins (Hui 1992, Thiel 2014)

Primary chemical vitamin form in food	Vitamin analogue chemical form (called natural)
Vitamin A/Beta-carotene; retinyl esters; mixed carotenoids	Vitamin A acetate; vitamin A palmitate; beta-carotene (isolated)
Vitamin B-1; thiamin pyrophosphate (food)	Thiamin mononitrate; thiamin hydrochloride; thiamin HCL
Vitamin B-2; riboflavin, multiple forms (food)	Riboflavin (isolated); USP vitamin B2
Vitamin B-3; niacinamide (food)	Niacin (isolated); niacinamide (isolated)
Vitamin B-5; pantothenate (food)	Pantothenic acid; calcium pantothenate; panthenol
Vitamin B-6; 5'0 (beta-D) pyridoxine	Pyridoxine hydrochloride; pyridoxine HCL
Vitamin B-9; folate	Folic acid
Vitamin B-12; methylcobalamin; deoxyadenosylcobalamin	Cyanocobalamin; hydroxycobalamin
Choline (food); phosphatidyl choline (food)	Choline chloride; choline bitartrate
Vitamin C; ascorbate (food); dehydroascorbate	Ascorbic acid; most mineral ascorbates (i.e. sodium ascorbate)
Vitamin D; mixed forms, primarily D3 (food)	Vitamin D1 (isolated); Vitamin D2 (isolated); Vitamin D3 (isolated) ; Vitamin D4; ergosterol (isolated); cholecalciferol (isolated); lumisterol
Vitamin E; RRR-alpha-tocopherol (food)	Vitamin E acetate; Mixed tocopherols; all-rac-alpha-tocopherol; d-l--alpha-tocopherol; d-alpha-tocopherol (isolated); dl-alpha-tocopheryl acetate; all acetate forms
Vitamin H; biotin	All non-yeast or non-rice vegetarian biotin forms
Vitamin K; phyloquinone (food)	Vitamin K3; menadione; phytonadione; naphthoquinone; dihydro-vitamin K1

The belief that body cannot recognize whether a vitamin in the bloodstream came from natural products or from laboratories is quite misconception for several reasons (Whitney et al., 1987). First, it seems to assume that the process of getting the amount of the vitamin into the bloodstream is the same, which is frequently not the case (Shils, 1999). Secondly, particle size is an important factor in nutrient absorption even though particle size is not detected by chemical assessment. Thirdly, the food factors that influence the absorption of nutrients relate not only to the nature of the nutrients themselves, but also their interaction with each other and with the non absorbable components of food (Jenkins et

al., 1994). Fourthly, the physic-chemical form of a nutrient is a major factor in bioavailability, and food and non-food vitamins are not normally in the same form (Macrae et al., 1993). Fifthly, most non-food vitamins are crystalline in structure (Budvari, 1996).

Food vitamins are in the physic-chemical forms which the body recognizes, contain food factors that affect bioavailability, appear to have smaller particle sizes and generally are not crystalline in structure (Fig. 8). This does not mean that non-food vitamins do not have any value (they clearly do), but it is important to understand that natural food complex vitamins have actually been shown to be better than isolated, non-food, vitamins.

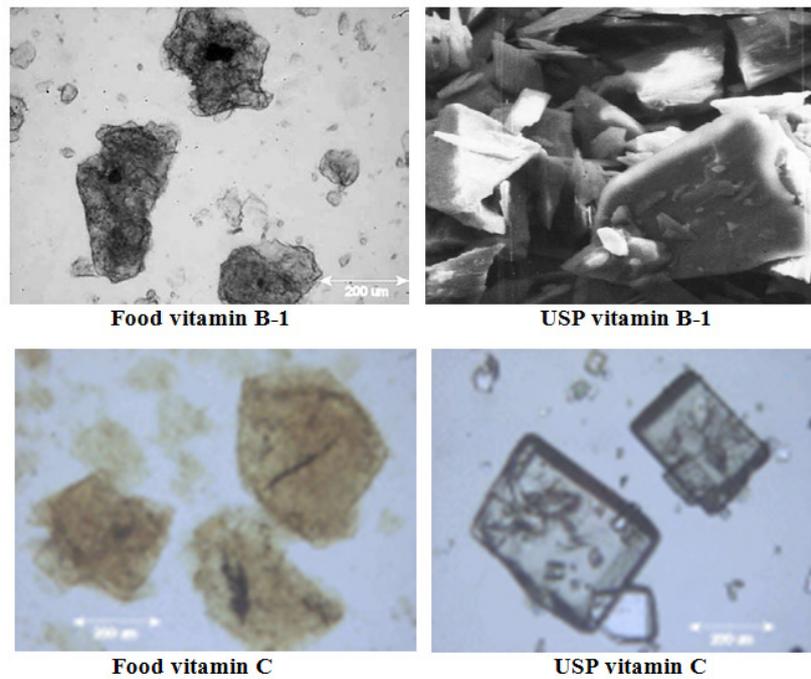


Figure 8. Electronic photos and structural differences of food vitamins and isolated USP vitamins (Thiel, 2014)

Conclusion

Science cannot create life. Only life can create life. Obviously, there is a difference. Supplements food-based, isolated or synthetic, has detracted from the most important part of health and healing. The basics of proper diet, exercise, detoxification, structure, mental/emotional and spiritual health must all be in order for true healing to occur. No supplement will work on its own if these foundations are not in place. However, even when these foundations are in place, or if the situation is acute enough to necessitate a more immediate treatment response, supplement support may still be needed for a while. You may also want to take one or more food-based supplements to ensure you are getting an adequate array of nutrients in your diet. When these situations arise, it is recommend food-based supplements be your first choice. How to know whether or not a supplement good choice? For starters, make sure it has the following characteristics: it is as close as possible to its natural form. The utmost care has been taken in all phases of its production, from growing its ingredients, to manufacturing, testing for potency and quality control. Select from companies that have a long track record of providing high quality products that produce

good clinical results.

Most vitamins sold are not food. They are synthetically processed petroleum and/or hydrogenated sugar extracts, even if they say “natural” on the label. They are not in the same chemical form or structural form as real vitamins are in foods; thus they are not natural for the human body. True natural food vitamins are superior to synthetic ones. Food vitamins are functionally superior to non-food vitamins as they tend to be preferentially absorbed and/or retained by the body. Isolated, non-food vitamins, even when not chemically different are only fractionated nutrients.

Studies cited throughout this paper suggest that the bioavailability of food vitamins is better than that of most isolated USP vitamins, that they may have better effects on maintaining aspects of human health beyond traditional vitamin deficiency syndromes, and at least some seem to be preferentially retained by the human body. It is not always clear if these advantages are due to the physiochemical form of the vitamin, with the other food constituents that are naturally found with them, or some combination. Regardless, it seems logical to conclude that for purposes of maintaining normal health, natural vitamins are superior to synthetic ones. Unlike some synthetic

vitamins, no natural vitamin has been found to not perform all of its natural functions. The truth is that only foods, or supplements composed of 100% foods, can be counted on as not containing non-food vitamin analogues. How do you know if the vitamins on your kitchen counter are from whole foods or if they are synthetic? If the list of ingredients includes an actual vitamin like vitamin C” rather than an actual food that contains natural vitamin C like “acerola cherry powder”, you can bet that it is a synthetic vitamin. If you choose to use nutritional supplements, it is in your best interest to use only those products that list actual foods as their ingredients rather than synthetic and isolated vitamins. While some synthetic and isolated vitamins have been shown to provide minimal health benefits, on the whole, most of them cause more harm than good and you are far better off spending your money on whole foods. It is important to note that the principles in this article are just as relevant and applicable to minerals and mineral supplements.

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