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FOR IMMEDIATE RELEASE

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Dietary Supplements and Wellness: A Pragmatist's Primer

by Michael Passwater, Assistant Editor

OMNS (June 6, 2023) There are over 50,000 dietary supplement products marketed in the United States, and approximately 75% of Americans take at least one dietary supplement regularly. Supplement consumers are more likely to lead a healthy lifestyle: to exercise, eat a balanced diet, visit their doctor regularly, and regularly get a good night's sleep. [1] As I was led to learn about dietary supplements and have been a consumer of them throughout my life, I am sometimes asked about these products. This article is an attempt to introduce basic concepts, and hopefully promote wise choices to allow readers to achieve value from their wellness strategies.

Rule #1 - Dietary supplements are intended to add nutrition to our day - to help fill gaps and to help overcome individual enzyme deficiencies. They are not intended to replace food or to cancel bad food choices. When possible, limit or eliminate exposure to harmful substances.

Rule #2 - What we eat is very important, but that is just one component of wellness. We are what we eat, but we are also what we think, and what we do.

Rule #3 - Biochemical Individuality is important. Our differing genetics and lifestyle cause widely different biochemical needs. No two people have the exact same needs and optimal plan.

Rule #4 - The goal of nutrition is to help us live our best, most functional lives - to make the most of what we have. Some essential nutrients have been proven to reduce the risk of birth defects (e.g. folic acid and neural tube defects). Essential nutrients taken at appropriate doses for individual needs can improve management of some unfortunate inherited conditions. See Rule #3. Developing cancer at 80 vs. 60 vs. 40 years of age is different. Extending the functional lifespan by even a few years can be meaningful, and will appear different for each person.

Pillars of Wellness

Mindset - Joy, gratitude, peace, and resiliency are important components of success and wellness. The human brain is a dynamic organ with extraordinary capabilities and flexibility. It also must be well fed to support its enormous metabolic needs and structural requirements. However, those who have survived the most horrific experiences with little to no nutritional options on battlefields, in prisoner of war camps, and in holocaust camps remind us of the overarching importance of mental discipline, grit, and encouragement. Hope and mindset matter.

"Elegant demonstration of nervous system control [of the immune system] is provided by studies showing suppression of conventional immune responses and enhancement of NK cell activity by classical Pavlovian conditioning. ... Numerous investigations alleging an adverse effect of psychological factors such as bereavement upon immune function are leading us with tiny faltering steps to a new age of "psychoimmunology". ~ Ivan Roitt (former head of the departments of Immunology and Rheumatology Research University College and Middlesex School of Medicine, author of Essential Immunology)

A few good reads:

Marion Cleeves Diamond (1988) Enriching Heredity: The Impact of the Environment on the Anatomy of the Brain. The Free Press.

Dale Carnegie (1948, revised 2018) How to Stop Worrying and Start Living. General Press.

Shawn Achor (2018) Big Potential. Currency Press.

Movement - Whether formal exercise or not, keep moving. Staying active helps the whole body and mind. Exercise mobilizes white blood cells, improves circulation, builds endurance, improves sleep, and has positive epigenetic effects on thousands of genes. As Theodore Roosevelt learned from Squire Bill Widener, "Do what you can with what you've got, where you are." Keep moving!

Sleep - We all need rest. Sleep involves a complicated series of stages that have mental and physical regenerative impact. There are organ specific stem cells that are only active doing repair work during certain phases of sleep. As motivational speaker Jon Gordon says, "You can't replace sleep with a double latte." Human biology is more complicated than a coffee shop. Sleep is critical to long term wellness.

Nutrition

Eat well - Eat a nutrient-dense varied diet. It is hard to find a case study of someone harmed by

eating too many fruits and vegetables. Store bought fruit juices are not the same as eating fruit. They tend to have more sugar and less nutrients per unit volume. Be sure to consume fatty acids, aiming for greater than 500 mg per day of the long chain omega-3 fatty acids DHA and EPA, and an omega-3 to omega-6 ratio greater than 1/4. Don't be afraid of omega-9 fatty acids such as oleic acid. Studies of people consuming olive oil and the "Mediterranean diet" consistently show favorable results. [2] Avoid artificial trans fats, and limit simple sugars. Fermented foods such as yogurt, natto, miso, olives, and sauerkraut are important sources of nutrients and gut-friendly bacteria. Eggs and whole milk can be excellent nutrient dense foods. Pay attention to what you eat and how you feel as you vary your diet. Food allergies and intolerances are common, and individualized. If you have a wheat allergy or celiac disease avoid all wheat (gluten). If you have allergies to oats, tomatoes, or peanuts, avoid those foods.

Many adults lose the ability to make lactose, causing gastric distress with the consumption of dairy products. Lactase supplements or dairy products supplemented with lactase can allow proper digestion of nutrient dense dairy products. Similarly, gastric enzyme supplements can aid in the digestion of fats and proteins, especially for those who have had gastric surgery, gallbladder removal, or pancreatic diseases. Ultra-processed foods are convenient, but often involve unwanted surprises. Artificial trans fats were allowed in US foods until 2020. California recently became the first state to outlaw brominated vegetable oil, potassium bromate, propylparaben, red dye #3, and titanium dioxide beginning in 2025. Sometimes knowing what not to eat is more important than deciding what to eat.

Dietary Supplements

"Don't take chances, take vitamins." (Helen Saul Case)

A note of common sense: If you have diseases hindering the metabolism of minerals such as iron (hemochromatosis) or copper (Wilson's disease) avoid supplements containing iron and copper. People with glucose-6-phosphate dehydrogenase (G6PD) deficiency should avoid intravenous vitamin C and high dose oral vitamin C supplementation. If you have young children in your home, childproof your home, including protecting them from unintentional consumption of supplements and medications.

Supplement math: 1 gram (g) = 1000 milligrams (mg) = 1,000,000 micrograms (mcg). 1 mg = 1000 mcg.

Can I trust dietary supplements since they are not regulated by the FDA? Actually, the FDA and FTC are both involved in the regulation of dietary supplement manufacturing, labeling, health claims, and marketing. The FDA regulates both finished dietary supplement products and dietary ingredients. Manufacturers must register with the FDA and product production and holding facilities are inspected periodically. 21 CFR 190 and 211 applies. 96% of supplement consumers have confidence in the safety and quality of vitamin and mineral supplements. That confidence level drops to 75% for specialty supplements, 72% for herbals and botanicals, and 63% for sports nutrition and weight management supplements. [3]

Are "chemical free" vitamins better? Technically, all physical matter is made of atoms arranged into chemicals. Vitamins are small biomolecules that are relatively easy to mass produce. Manufactured vitamin C (L-ascorbic acid, C₆H₈O₆) is the same L-ascorbic acid vitamin C molecule found in oranges. [4] Concerns regarding "chemicals" involve what other undesirable substances are also in the product. Fillers, binders, adhesives, and other excipients in addition to impurities may be

problematic. Read labels carefully. If taking large or frequent doses, as is often desired with vitamin C or niacin, consider powder products to minimize the extra non-nutrient contents necessary to hold pills together. If you open a bottle of pills and it smells like acetone (nail polish remover), consider another manufacturer.

Are "whole food" vitamins better? Whole food vitamins are an attempt to concentrate a broader mix of nutrients naturally contained in a fruit or vegetable into a pill. The concept is natural synergy and inclusion of substances not yet characterized or contained in other supplements. However, the result is typically a higher price and a lower dose of key nutrients. When wholeness is of interest, skip the pill - strawberries, kiwi fruit, blueberries, Kakadu plums, Jamaica cherries, broccoli, Brussels sprouts, asparagus, and red onions are excellent "whole food nutrient packages" available in the grocery store produce section or farmer's market. [5]

Multivitamin use -- has increased from 58% in 2019 to 70% in 2022. [1,3] Be sure to check the serving size. Many good multivitamins are no longer "one a day" pills. They may require 2 or 3 pills to achieve the doses listed on the label. This has the advantage of providing meaningful amounts of nutrients in easy to swallow pills, but is a factor to be aware of when calculating product value and ensuring proper dosing. The COSMOS-Mind prospective randomized controlled trial showed improved global cognition, memory, and executive function in people 65 years old or older taking a multivitamin-mineral supplement every day for 3 years compared to those taking a placebo. [6]

Vitamin C - It is perplexing that only a third of supplement consumers take vitamin C. Humans are unable to make their own vitamin C, and vitamin C is required for many biological processes, including: neuropeptide and neurotransmitter synthesis, catecholamine biosynthesis, tetrahydrobiopterin recycling, redox regulation, collagen and elastin synthesis, carnitine biosynthesis, breakdown of L-tyrosine, primary antioxidant functions, proteosomal degradation of HIF-1alpha, epigenomic regulation, somatic stem cell reprogramming, and immune functions. [7-14] Researchers from Dr. Lee in the 1950s-1960s through Dr. Catravas in 2017, conclusively demonstrated the importance of vitamin C in endothelial (blood vessel) health and repair. [15-21] In addition to satisfying a broad spectrum of needs, vitamin C doses have a wide margin of safety. [22] The highest known oral dose of vitamin C taken before achieving bowel tolerance was 120 grams in a day. That was an extreme example and the individual had significant occupational pesticide exposure. [23] Well over half a million doses of IV vitamin C (from 1g - 100g per infusion) have been safely given throughout the world. The half-life of vitamin C in the bloodstream is short, hours in good health, minutes during critical illness when recycling mechanisms are compromised and vitamin C is irreversibly oxidized. Divided doses, for example with each meal, are advised. Powders are convenient for mixing into water or other beverages, minimize consumption of fillers, and allow multiple applications. Vitamin C can be absorbed through the skin, and throughout the digestive tract. Powders allow easy preparation of pastes for application to skin lesions, gargles, drinks, or rectal administration for those unable to swallow. Mineral ascorbate forms of vitamin C are non-acid and generally cause less gastrointestinal irritation. These products typically provide 100 - 120 mg of the mineral (sodium, calcium, magnesium, or zinc) with each gram (1000 mg) of vitamin C. Sodium ascorbate taken at high doses does not have the same negative impact on the body as sodium chloride (table salt) due to the absence of the chloride ion. Vitamin C intake requirements increase in the elderly due to decreased absorption and increased bodily demand. Concerns regarding kidney stones are not supported by clinical experience with individuals receiving high dose vitamin C.

B vitamins - The eight B vitamins are thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folate or folic acid (B9), and cyanocobalamin (B12). There is wisdom in taking them together in a balanced "B complex" supplement for general health. Doses of B1, B2, B3, B5, and B6 are typically measured in milligrams (mg) while B7, B9, and B12 doses are typically measured in micrograms (mcg). However, numerous conditions may warrant larger doses of one or more specific B vitamins. Some individuals benefit from gram quantities of B3. Niacin and niacinamide are both forms of vitamin B3. Nicotinamide is an alternate name for niacinamide,

whereas nicotinamide riboside and nicotinamide mononucleotide are related drug molecules that are more expensive and not generally recommended as a substitute for niacin. [24] Niacin may cause a skin flush and helps reduce blood cholesterol. Niacinamide will not cause a flush, does not reduce blood cholesterol, and is generally preferred for skin conditions. [25-27] Niacinamide is also preferred in the setting of cancer as it is harder for some tumors to process, allowing healthy cells to preferentially benefit from the nutrient.

Magnesium - Magnesium is an essential cofactor for hundreds of biochemical reactions which impact neurological and muscular function, vitamin D metabolism, membrane permeability, DNA and protein synthesis, and blood pressure. Daily requirements are typically 3 - 4.5 mg per kg body weight. However, more must be ingested to meet this bodily need. Intestinal absorption is incomplete, varying from 80% to less than 20% depending on the form and dose ingested, existing magnesium status, intestinal acidity, and matrix effects. Absorption is improved when taken with protein and in divided doses, and greatly diminished in people taking antacids or if taken with calcium, phosphorus, iron, manganese, copper, or zinc. Magnesium absorption tends to decline with age. The citrate, gluconate, glycinate, and chloride forms are better absorbed than magnesium oxide. [28-31]

Vitamin D - maintaining a blood vitamin D level in the 40 - 80 ng/mL range is associated with many health benefits. [32] Midday overhead sunlight, fatty fish, and D3 supplements are good sources of vitamin D. From October through February, sunlight provides inadequate vitamin D production north of Los Angeles and Atlanta (34 degrees latitude). Even in Miami, FL, little vitamin D can be produced from sunlight in November through January. The half life of vitamin D in the body is approximately 2 months. People in the continental US depend on dietary supplements to maintain healthy levels of this important vitamin-hormone through the winter.

Vitamin K2 - Vitamin K2 (menaquinone) is important for healthy calcium metabolism, heart and brain health, and inflammation management. This function in the body is different than vitamin K1. A dose of 100 mcg vitamin K2 is recommended for each 125 - 250 mcg (5,000 - 10,000 IU) of vitamin D3. Separate supplements of K2 and D3 are less expensive, but if minimizing the number of pills is desired, a combo D3/K2 supplement may be of value. Green leafy vegetables, natto, and dairy products contain vitamin K2. Placebo controlled clinical trials using 180 mcg/day have shown benefits after 1 year, with more pronounced benefits after 2-3 years. [33]

Iron - is essential for brain, heart, and blood health. Iron deficiency anemia is common in young women and among senior citizens. By the time microcytic anemia occurs, the brain and heart have already been compromised. The chelated iron formula, iron bisglycinate, is better absorbed and minimizes side effects common with inorganic iron salts such as ferrous sulfate and ferrous fumarate. Meat, fish, dark chicken and turkey, and eggs are good sources of iron, as are a wide variety of vegetables including greens, broccoli, peas, and beans. Folic acid, vitamin B12, and vitamin C are helpful partners of iron absorption and building red blood cell mass. [34-36] An excess of iron is toxic and should be avoided.

Selenium - There are 25 known proteins that contain selenium as the amino acid selenocysteine. These proteins have a wide range of functions throughout the body including regulation of DNA transcription and RNA translation, immune function, coagulation, and brain function. Selenocysteine is also an important factor in interactions between some viruses and human cells, and for reducing pathogenic mutations in some viruses. Methyl-selenocysteine (MSC) has shown favorable results in clinical trials of cancer prevention, while clinical trials using selenomethionine have not. The short-term use of selenite injections has shown favorable results in the treatment of acute viral syndromes and as an adjunct cancer treatment. [37-42] High doses of selenium (> 400 mcg/d) can be toxic and should be avoided.

Vitamin E - Eight compounds comprise the Vitamin E family, four tocopherols and four

tocotrienols. [4] Mixed tocopherols and tocotrienol products are worth the extra price. To maximize absorption of the more powerful tocotrienols, it is best to take tocotrienols and tocopherols at least 6 hours apart (e.g. one with breakfast, the other with dinner). Delta tocotrienol has been used in solid tumor and heart disease studies with intriguing results. There is still much to learn about the best approaches to vitamin E supplementation in a variety of settings. [43-66] One thing that is clear is the compounding positive effects with increasing years of steady intake. A population study involving nearly 18,000 people, conducted by Linus Pauling and Richard Passwater in the 1970s, showed a statistically strong association between vitamin E intake and a reduction in heart disease. The relationship was related to time and dose. Taking 400 IU or more for 10 years or more before the age of 80 was associated with reducing the incidence of heart disease to 10% of the standard rate at the time (from 32 per 100 to 3 per 100). Taking 1200 IU for 4 years or more was associated with a rate reduction from 32 per 100 to 10 per 100. [Prevention Magazine, 1976 Jan - May and Jul - Sep issues; Chapter 10, Supernutrition for Healthy Hearts, 1977] Warnings about vitamin E safety continue in mainstream media but are contradicted by many studies. [67]

Lysine - Lysine is one of 9 dietary essential amino acids (the others are leucine, isoleucine, methionine, phenylalanine, tryptophan, threonine, valine, and histidine). In addition to its necessity for general protein building, lysine (5-6 g/day), along with vitamin C (6-18 g/day) and proline (1-2 g/day) comprise the Pauling-Rath Therapy for cardiovascular disease. <http://orthomolecular.org/resources/omns/v18n27.shtml> Lysine also has anti-viral and antifibrinolytic properties.

Probiotics - Technically not an essential dietary supplement, but the importance of a healthy gut microbiome is becoming more obvious each year. The evidence favors taking a probiotic during and following antibiotic treatment to reduce side effects. It is reasonable to start simple with the time-trusted inexpensive staple, *Lactobacillus acidophilus*. Increase strength and number of bacteria strains if needed.

Fluoride - Fluoride is not a nutrient. It generally increases the hardness of tooth enamel and the density of spinal bones but decreases the density of bones in the arms and legs. Multiple government funded studies have associated exposure to artificially fluoridated water during fetal and early childhood development with lower IQ. Avoid this environmental toxin when possible, especially if pregnant or nursing. Dr. Paul Connett has pointed out, "Most developed countries, including Japan and 97% of the western European population, do not consume fluoridated water. In the U.S., about 70% of public water supplies are fluoridated. This equates to approximately 185 million people, which is over half the number of people drinking artificially fluoridated water worldwide." <https://fluoridealert.org/articles/50-reasons/> [68]

Selected favorite "non-dietary essential" supplements

Lecithin (phosphatidylcholine) - is the third major constituent of bile. It helps dissolve lipids, including cholesterol, in the intestines, hepatic-biliary ducts (gallstones), and in blood. Good lecithin supplements also contain a balanced mixture of linoleic acid and linolenic acid. [69-71]

Grape Seed Extract - contains lectins with affinity for norovirus. Norovirus outbreaks are common in autumn, spring, and on cruise ships. Some restaurants use cleaners containing grape seed extract. Some food particles, including dairy products, neutralize these lectins. When needed, grape seed extract is best taken with water on an empty stomach.

Coenzyme Q10 and Benfotiamine - Humans can produce CoQ10, but as we age, demand tends to exceed production. These nutrients are important for cellular energy production. People who struggle with congestive heart failure and those who care for them speak well of CoQ10 and Benfotiamine (a lipid soluble form of thiamine).

Green or Black Tea - contains antioxidant, anti-inflammatory, anti-coagulant properties demonstrated in many clinical trials.

Pycnogenol - French maritime pine bark extract with strong anti-inflammatory properties backed by many studies. [\[72\]](#)

N-acetyl-cysteine (NAC) - a rich source of the sulfur containing amino acid cysteine. NAC has many uses in the body, and is a precursor in the biosynthesis of the major intracellular antioxidant, glutathione. NAC is a standard emergency medicine antidote for acetaminophen overdose. Homes with acetaminophen should also have NAC. Alpha-Lipoic-Acid is also a good source of supplemental cysteine, and has lipid soluble as well as water soluble properties. Lipoic acid and biotin are helpful for neuropathy.

Omega-3 supplements - may be helpful to ensure an intake of more than 500 mg of DHA per day. Although it is not essential and can be made by the body from short-chain omega-3 fatty acid (alpha-linolenic acid), DHA comprises half of the weight of the brain, and is important throughout the body. Fish allergies are common, but fish-free sources of DHA include soy, algae, and seaweed. Good sources of alpha-linolenic acid are walnuts, flaxseed meal. Maintaining a blood omega-3 index greater than 8% is associated with improved health.

Rutin - a natural substance in apples, classified as an inhibitor of protein disulfide isomerase (PDI). It has the unique ability to aid in both the prevention and degradation of clots. Rutin is a supplement to consider if taking birth control pills (1 - 5 fold elevated clot risk), during and for a few days after long travel (>6 hrs), and during recovery from systemic infections (2-20 fold increased clot risk). [\[73-77\]](#)

Evening Primrose Oil - I have never taken this supplement, but women over 30 may wish to consider it. My wife and mother don't let this supplement run out. Enough said.

Summary

"We don't know all the answers. ... We keep looking, searching, trying to get more knowledge."
(Francois Henri "Jack" LaLanne)

Our knowledge of the universe, human biology, and manufactured and natural food sources is tremendous, yet still incomplete. We have much to learn about the finer details of specific dietary supplement formulas, administration doses, routes, and timing to maximize wellness. However, we do not need to let what we don't know stop us from taking advantage of what we do know. Each person is unique with their own set of genes and environmental stresses. Therefore, each person's wellness plan and path to success will be different. Addressing widespread deficiencies with a high-dose multivitamin, and testing along with trial and error to determine specific individual nutrient deficiencies can inform the best use of foods and dietary supplements. Access to a wide variety of supplements allows choice of the best products to efficiently meet individual needs, avoid allergies, and support food preferences. Like small steady deposits into an interest-bearing bank account, the benefits of good nutrition and lifestyle choices compound over the years.

My Basic Dietary Supplement Plan

With Meal One

Vitamin C, 1g, 11 cents
Vitamin D3, 125 mcg (5000 IU), 8 cents
Vitamin K2, 100 mcg, 28 cents
Omega-3 Fish Oil, 500 mg EPA/DHA, 18 cents
A really good Multivitamin & Multimineral, 83 cents
Selenium (Se-methyl L-selenocysteine), 200 mcg, 9 cents
Probiotic (e.g. Advanced Acidophilus Plus), 12 cents

With Meal Two

Vitamin C, 1g, 11 cents
Vitamin E, 268 mg (400 IU) (e.g. high gamma vitamin E with mixed tocopherols), 42 cents
B-complex 100, 25 cents
Magnesium citrate, 200 mg, 12 cents

Full retail cost = \$2.59/day (\$945.35 per year). Dietary supplements have a long shelf life which is conducive to stocking up during sales (\$710/yr is easily achievable for the above quantities).

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