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COMPREHENSIVE NUTRITIONAL SCAN

Sample Demo (patient supplementing evening primrose oil with known B6 need)

Signal	Lvl	% Imbalance	7/18/26 notes	
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Other Essential Amino Acids -> Histidine The histidine amino acid is a precursor for histamine, an amine produced in the body necessary for inflammation. Histidine is also a precursor for carnosine biosynthesis, which is a dipeptide found in skeletal muscle. Low - check dietary protein, or malabsorption if other essential AAs are low. Low histidine is associated with rheumatoid arthritis, folate deficiency, and/or salicylate/steroid use. High - may indicate excessive protein intake. If high 3-Methylhistidine, muscle protein breakdown is indicated.	6		98	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 6 -> Gamma Linolenic Acid (18:3n6) Although GLA is an n-6 fatty acid, a type of acid that is, in general, pro-inflammatory, it has anti-inflammatory properties. Gamma linolenic acid (18:3n6), abbreviated GLA, is the precursor of DGLA, an anti-inflammatory fatty acid, and it's also the precursor of arachidonic acid, a pro-inflammatory fatty acid. It is found in hemp, borage, black currant, and evening primrose oils. It can be produced in human tissues by the action of desaturase enzymes on LA. GLA corrects most of the biological effects of zinc deficiency, highlighting the zinc requirement of the delta 5 desaturase enzyme.	11		98	
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Other Essential Amino Acids -> Threonine Low - can result in hypoglycemic symptoms, particularly if glycine or serine is also low. Supplement threonine/BCAAs. High - excessive dietary intake or possible insufficient metabolism of threonine. The initial step here requires zinc to phosphorylate vitamin B6 to its active	10		97	

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coenzyme form, so supplementation with vitamin B6 and zinc can be helpful.				
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Limiting Amino Acids -> Methionine Together with cysteine, methionine is one of two sulfur-containing proteinogenic amino acids. Low- possible poor-quality protein diet. Adverse effects on sulfur metabolism. Improve dietary methionine intake or supplement. High- excessive intake of methionine-rich protein or inefficient metabolism. If other sulfur-containing AAs are low, then enhance methionine utilization by adding the necessary cofactors, magnesium and vitamin B6.	9		97	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Phosphoserine Phosphoserine is an ester of serine and phosphoric acid. Elevated levels suggest functional magnesium deficiency arising from incomplete conversion to serine.	1		96	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 6 -> Eicosadienoic Acid (20:2n6) Eicosadienoic acid (20:2n6) is the elongation product of GLA and the direct precursor of DGLA. Levels of this fatty acid reflect levels of other polyunsaturated omega-6 fatty acids. Plasma levels are significantly lower than those present in erythrocytes, which indicates that the conversion of linoleic to eicosadienoic acid occurs at a higher rate than the conversion of eicosadienoic acid to DGLA.	1		94	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 3 -> Eicosapentaenoic Acid (20:5n3) EPA is a polyunsaturated fatty acid (PUFA) that acts as a precursor for prostaglandin-3 (which inhibits platelet aggregation), thromboxane-3, and leukotriene-5 eicosanoids. It is obtained in the human diet by eating oily fish or fish oil, e.g. cod liver, herring, mackerel, salmon, menhaden and sardine, and various types of edible seaweed and phytoplankton. It is also found in human breast milk. The human body converts alpha-linolenic acid (ALA) to EPA. ALA is itself an essential fatty acid, an appropriate supply of which must be ensured. The efficiency of the conversion of ALA to EPA, however, is much lower than the absorption of EPA from food containing it. Because EPA is also a precursor to docosahexaenoic acid (DHA), ensuring a	12		92	

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sufficient level of EPA on a diet containing neither EPA nor DHA is harder both because of the extra metabolic work required to synthesize EPA and because of the use of EPA to metabolize into DHA. Medical conditions like diabetes or certain allergies may significantly limit the human body's capacity for metabolization of EPA from ALA. Deficiency of eicosapentaenoic acid (20:5n3) is likely the most prevalent fatty acid abnormality affecting the health of individuals in western societies. Low levels in plasma or especially in erythrocytes are indicative of insufficiency. Arthritis, heart disease, and general aging result from direct or indirect effects of unchecked inflammatory response. Eicosapentaenoic acid (EPA) is anti-inflammatory and should balance the levels of pro-inflammatory arachidonic acid. Although EPA can be produced from the essential fatty acid, ALA, dietary intakes of this fatty acid are generally poor. The conversion also requires the action of the delta 6 desaturase enzyme that may be low due to inadequate Zn, Mg, or vitamins B3, B6, and C. Such an enzyme impairment would be indicated if EPA is low and ALA is normal or high. High levels of saturated, monounsaturated, trans fatty acids, and cholesterol also slow the conversion of ALA to EPA (as well as GLA to DGLA).				
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Other Essential Amino Acids -> Phenylalanine Phenylalanine is found naturally in the breast milk of mammals. It is used in the manufacture of food and drink products and sold as a nutritional supplement for its reputed analgesic and antidepressant effects. It is a direct precursor to the neuromodulator phenethylamine, a commonly used dietary supplement. L-Phenylalanine is biologically converted into L-tyrosine, another one of the DNA-encoded amino acids. Tyrosine (or its precursor phenylalanine) is needed to synthesize the benzoquinone structure which forms part of coenzyme Q10. L-tyrosine in turn is converted into L-DOPA, which is further converted into dopamine, norepinephrine (noradrenaline), and epinephrine (adrenaline). The latter three are known as the catecholamines. Phenylalanine uses the same active transport channel as tryptophan to cross the blood-	9		92	

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brain barrier. In excessive quantities, supplementation can interfere with the production of serotonin and other aromatic amino acids as well as nitric oxide due to the overuse (eventually, limited availability) of the associated cofactors, iron or tetrahydrobiopterin. Low- can result in altered thyroid function and catecholamine deficits including symptoms of depression, cognitive disorders, memory loss, fatigue, and autonomic dysfunction. Reduce lifestyle stressors and supplement phenylalanine. High- high protein intake or a block in the conversion of phenylalanine to tyrosine. Iron, vitamin C, and niacin are necessary for this enzymatic step. Check tyrosine level and, if low, supplement tyrosine and iron.				
Nutritional Profile -> Fatty Acids -> Ratios -> LA/DGLA Ratio The ratio of LA to DGLA increases when the delta6 desaturase enzyme is inhibited by zinc and magnesium deficiency, elevated insulin, or dietary excess of saturated, monoenoic, or trans fatty acid. Under these conditions, the enzyme cannot convert the substrate (LA) to its product (DGLA) fast enough. The production of all desaturation products is affected, including GLA, EPA and AA. These longer chain polyunsaturated fatty acids must be supplied from the diet or supplements.	9		91	
Nutritional Profile -> Fatty Acids -> Monounsaturated -> Myristoleic Acid (14:1n5) Myristoleic acid, or 9-tetradecenoic acid, is an omega-5 fatty acid. It is biosynthesized from myristic acid by the enzyme delta-9 desaturase, but it is uncommon in nature. One of the major sources of this fatty acid is the seed oil from plants of the family Myristicaceae, comprising up to 30 per cent of the oil in some species. It is a constituent of Serenoa or Saw palmetto. The medium-chain unsaturated myristoleic acid (14:1n5) accumulates in adipose tissue with the consumption of milk products, which are rich sources of the fatty acid. Myristoleic acid is particularly good at increasing cell membrane fluidity because of its short chain length and unsaturated status. Diets high in saturated fat lead to low membrane fluidity. Therefore, increased membrane fluidity is generally a favorable health consequence. However, high levels of myristoleic acid may raise concern when found in cancer	6		88	

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patients because of the tumor-promoting effect of high membrane fluidity.				
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Anserine Anserine (ß-alanyl-N-methylhistidine) is a dipeptide containing ß-alanine and histidine, which can be found in the skeletal muscle and brain of mammals and birds. High dietary intake of poultry can contribute to elevated anserine. Zinc is required for the normal conversion to ß-alanine plus 1-methylhistidine.	5		84	
Nutritional Profile -> Vitamins and Minerals -> Vitamin D Vitamin D refers to a group of fat-soluble secosteroids responsible for increasing intestinal absorption of calcium, iron, magnesium, phosphate, and zinc. In humans, the most important compounds in this group are vitamin D3 (also known as cholecalciferol) and vitamin D2 (ergocalciferol). Very few foods contain vitamin D; synthesis of vitamin D (specifically cholecalciferol) in the skin is the major natural source of the vitamin. Dermal synthesis of vitamin D from cholesterol is dependent on sun exposure (specifically UVB radiation). Vitamin D from the diet or dermal synthesis from sunlight is biologically inactive; activation requires enzymatic conversion (hydroxylation) in the liver and kidney. Food sources include mushrooms, alfalfa, lichen, fatty fish, egg yolk, and liver.	4		82	
Nutritional Profile -> Vitamins and Minerals -> Vitamin B9 Folic Acid Folic acid plays a key role in coenzymes involved in DNA and SAMe synthesis, methylation, nucleic acids & amino acid metabolism and RBC production.Low folate may result from alcoholism, high-dose NSAIDs, diabetic meds, H2 blockers, some diuretics and anti-convulsants, SSRIs, methotrexate, trimethoprim, pyrimethamine, triamterene, sulfasalazine or cholestyramine.Folate deficiency can result in anemia, fatigue, low methionine, increased homocysteine, impaired immunity, heart disease, birth defects and CA risk. Food sources include fortified grains, green vegetables, beans & legumes	3		82	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Phosphoethanolamine Phosphoethanolamine (PE) is a phosphomonoester metabolite of the phospholipid metabolism. PE is a precursor of phospholipid synthesis and a product of phospholipid breakdown. Phosphomonoesters are present at much higher levels in brain than in other organs. PE shows a strong structural	12		81	

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similarity to the inhibitory neurotransmitter, GABA, and the GABAB receptor partial agonist, 3-amino-propylphosphonic acid. Elevated levels suggest possible inhibition of choline and acetylcholine synthesis due to impaired methione metabolism involving methylation by SAM. Consider B12, folate, betaine, or SAM.				
Nutritional Profile -> Vitamins and Minerals -> Zinc Zinc plays a vital role in immunity, protein metabolism, heme synthesis, growth & development, reproduction, digestion and antioxidant function. Low levels may occur with malabsorption, alcoholism, chronic diarrhea, diabetes, excess Cu or Fe, diuretics, ACE inhibitors, H2 blockers or digoxin. Deficiency can result in hair loss and skin rashes, also impairments in growth & healing, immunity, sexual function, taste & smell and digestion. Food sources include oysters, organ meats, soybean, wheat germ, seeds, nuts, red meat, chicken, herring, milk, yeast, leafy and root vegetables.	3		81	
Nutritional Profile -> Fatty Acids -> Odd Chain -> Tricosanoic Acid (23:0) Tricosylic acid, or tricosanoic acid, is a 23-carbon long-chain saturated fatty acid with the chemical formula CH3(CH2)21COOH. Fatty acids with odd numbers of carbon atoms are produced primarily by initiating the synthetic series with the three carbon compound, propionic acid. Vitamin B12 is required for the conversion of propionate into succinate for oxidation in the central energy pathways. Deficiency of vitamin B 12 results in accumulation of propionate and subsequent buildup of the odd numbered fatty acids, pentadecanoic (15:0), heptadecanoic (17:0), nonadecanoic (19:0), heneicosanoic (21:0), and tricosanoic (23:0) acids. The bacteria in the gut of ruminants (grazing animals like cows and sheep) produce large amounts of propionate, which is absorbed and enters the metabolism of the animal. High intake of animal and dairy products favor high levels of these fatty acids. Alternatively, it is possible that the bacteria in the human gut could produce sufficient amounts of propionate to lead to elevation in the odd-carbon fatty acids. This would only occur under conditions of significant gut dysbiosis. Carnitine is required for fatty acid oxidation. In carnitine insufficiency, fatty acids are oxidized via an omega oxidation pathway that	12		81	

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creates odd chain units. Therefore, odd chain fatty acid accumulation may indicate carnitine deficiency and the need for supplementation.				
Nutritional Profile -> Vitamins and Minerals -> Vitamin A/Carotenoids Beta-carotene & other carotenoids are converted to vitamin A (retinol), involved in vision, antioxidant & immune function, gene expression & cell growth. Vitamin A deficiency may occur with chronic alcoholism, zinc deficiency, hypothyroidism, or oral contraceptives containing estrogen & progestin.Deficiency may result in night blindness, impaired immunity, healing & tissue regeneration, increased risk of infection, leukoplakia or keratosis. Food sources include cod liver oil, fortified cereals & milk, eggs, sweet potato, pumpkin, carrot, cantaloupe, mango, spinach, broccoli, kale & butternut squash.	12		80	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 6 -> Docosatetraenoic Acid (22:4n6) Docosatetraenoic acid designates any straight chain 22:4 fatty acid. Adenic acid is an example and is a naturally occurring polyunsaturated fatty acid formed through a 2-carbon chain elongation of arachidonic acid. It is one of the most abundant fatty acids in the early human brain. Docosadienoic acid (22:2n6) is a very long-chain fatty acid (VLCFA). It is the elongation product of DGLA. Elevated levels of docosadienoic acid should appear only under conditions of dietary adequacy of LA and DGLA, together with stimulation of elongation. The latter is one effect of insulin resistance. When omega-6 dietary fatty acids are consumed in abundance, there is an accumulation of desaturation and elongation intermediates. Diets high in fat and simple sugars contribute to obesity and to the accumulation of docosatetraenoic acid (22:4n).	12		79	
Nutritional Profile -> Fatty Acids -> Saturated -> Capric Acid (10:0) Capric acid occurs naturally in coconut oil (about 10%) and palm kernel oil (about 4%), otherwise it is uncommon in typical seed oils. It is found in the milk of various mammals and to a lesser extent in other animal fats.	9		79	

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Capric (10:0), lauric (12:0), and myristic (14:0) acids, the medium chain fatty acids (MCFAs), are present in small amounts in plant oils and butter. The MCFAs are virtually nonexistent in meats because animals oxidize them very rapidly from plants consumed, and do not accumulate in the tissues. Various "medium chain triglyceride" products have become available for lipid digestive disorders and have found use in athletic training. They contain MCFAs that are assimilated rapidly without the normal bile acid dispersal requirement. In human tissues, capric, lauric, and myristic acids are oxidized by peroxisomal oxidative pathways to a larger extent than the longer chain fatty acids. Elevated levels could indicate general suppression of peroxisomal oxidation which utilizes riboflavin-derived cofactors.				
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Asparagine A reaction between asparagine and reducing sugars or other source of carbonyls produces acrylamide in food when heated to sufficient temperature. These products occur in baked goods such as French fries, potato chips, and toasted bread. Asparagine is required for development and function of the brain. It also plays an important role in the synthesis of ammonia. Low - can reflect functional need for magnesium in the conversion from aspartic acid. High - Can indicate problems with purine (therefore protein) synthesis.	5		79	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> 3-Methylhistidine 3-Methylhistidine is a product of peptide bond synthesis and methylation of actin and myosin. The measurement of 3-Methylhistidine provides an index of the rate of muscle protein breakdown. Elevated levels suggest active catabolism of muscle protein which may be due to poor antioxidant status.	5		76	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 3 -> Alpha Linolenic Acid (18:3n3) One of the most common essential fatty acid deficiencies is that of alpha linolenic acid (18:3n3), abbreviated as ALA or LNA. It is found in flax, hemp, rape (canola) seed, soybean, walnut, and dark green leaves and must be	3		73	

supplied by such foods. Because of the central importance of this fatty acid and its counterpart, GLA, the clinical associations with dietary insufficiencies are broad.				
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Citrulline Citrulline is produced as a byproduct of the enzymatic production of nitric oxide from the amino acid arginine, catalyzed by nitric oxide synthase. Citrulline is made from ornithine and carbamoyl phosphate in one of the central reactions in the urea cycle. It is also produced from arginine as a by-product of the reaction catalyzed by NOS family. This is an essential reaction in the body as nitric oxide is an important vasodilator required for regulating blood pressure. Elevated levels suggest a functional enzyme block in the urea cycle, leading to ammonia buildup. Supplement magnesium and aspartic add to drive the cycle. Lower protein intake is suggested in ammonia toxicities.	9		73	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Ornithine L-Ornithine is one of the products of the action of the enzyme arginase on L-arginine, creating urea. Therefore, ornithine is a central part of the urea cycle, which allows for the disposal of excess nitrogen. Ornithine is recycled and, in a manner, is a catalyst. Ornithine is converted into a urea derivative at the d (terminal) nitrogen by carbamoyl phosphate. Another nitrogen is added from aspartate, producing the denitrogenated fumarate, and the resulting arginine (a guanidinium compound) is hydrolysed back to ornithine, producing urea. The nitrogens of urea come from the ammonia and aspartate, and the nitrogen in ornithine remains intact. Low - possibly due to low arginine, as it is synthesized from arginine. As a source of regulatory polyamines, a low levels can affect cellular metabolism. High - a possible metabolic block in urea cycle, causing excess ammonia burden. Confirm by checking for high glutamine, low glutamic acid.	4		71	
Nutritional Profile -> Fatty Acids -> Saturated -> Hexacosanoic Acid (26:0) Cerotic acid, or hexacosanoic acid, is a 26-carbon long-chain saturated fatty acid with the chemical formula CH3(CH2)24COOH. It is most commonly found in beeswax and carnauba wax, and is a white crystalline solid.	5		71	

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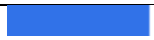
Accumulation of certain very long chain fatty acids (VLCFAs) is associated with degenerative diseases of the central nervous system. There are a number of genetic disorders involving accumulation of sphingolipids, usually due to the lack of enzymes necessary for the turnover of membrane VLCFAs, which include behenic (22:0), lignoceric (24:0), and hexacosanoic (26:0) acids as well as the unsaturated members of the C22-24 classes, particularly nervonic acid. The common lifestyle of low physical exertion and high fat diet sets a metabolic pattern that can lead to increasing levels of VLCFAs in plasma and erythrocyte membranes. The effect is mediated by hormonal responses, mainly norepinephrine and insulin, and is exacerbated by drugs that modulate energy metabolism such as the antianginal drug, trimetazidine.				
Nutritional Profile -> Vitamins and Minerals -> Magnesium Magnesium is involved in >300 metabolic reactions. Key areas include energy production, bone & ATP formation, muscle & nerve conduction and cell signaling. Deficiency may occur with malabsorption, alcoholism, hyperparathyroidism, renal disorders (wasting), diabetes, diuretics, digoxin or high doses of zinc. Low Mg may result in muscle weakness/spasm, constipation, depression, hypertension, arrhythmias, hypocalcemia, hypokalemia or personality changes. Food sources include dark leafy greens, oatmeal, buckwheat, unpolished grains, chocolate, milk, nuts & seeds, lima beans and molasses.	8		71	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 3 -> Docosapentaenoic Acid (22:5n3) Docosapentaenoic acid (DPA) is an n-3 fatty acid that is structurally similar to eicosapentaenoic acid (EPA) but has two more carbon chain units and none more double bond. The growth and development of the central nervous system is particularly dependent upon the presence of an adequate amount of the very long chain, highly unsaturated fatty acids, docosapentaenoic (22:5n3) and docosahexaenoic acids (22:6n3). Attention deficit hyperactivity	11		70	

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disorder and issues in the development of the visual system in EFA deficiencies are two examples of this dependency. Docosahexaenoic acid (DHA) is an important member of the very long chain fatty acids (C22 to C26) that characteristically occur in glycosphingolipids, particularly in the brain. Since this fatty acid is so important in early development, it is worth noting that the levels in breast milk are correlated with the mother's intake of fish oils, which are rich sources of both of these fatty acids. DHA intake may also help to lower blood pressure.				
Nutritional Profile -> Fatty Acids -> Odd Chain -> Pentadecanoic Acid (15:0) Pentadecanoic acid is a saturated fatty acid. Its molecular formula is CH3(CH2)13COOH. It is rare in nature, being found at the level of 1.2% in the milk fat from cows. Fatty acids with odd numbers of carbon atoms are produced primarily by initiating the synthetic series with the three carbon compound, propionic acid. Vitamin B12 is required for the conversion of propionate into succinate for oxidation in the central energy pathways. Deficiency of vitamin B 12 results in accumulation of propionate and subsequent buildup of the odd numbered fatty acids, pentadecanoic (15:0), heptadecanoic (17:0), nonadecanoic (19:0), heneicosanoic (21:0), and tricosanoic (23:0) acids. The bacteria in the gut of ruminants (grazing animals like cows and sheep) produce large amounts of propionate, which is absorbed and enters the metabolism of the animal. High intake of animal and dairy products favor high levels of these fatty acids. Alternatively, it is possible that the bacteria in the human gut could produce sufficient amounts of propionate to lead to elevation in the odd-carbon fatty acids. This would only occur under conditions of significant gut dysbiosis. Carnitine is required for fatty acid oxidation. In carnitine insufficiency, fatty acids are oxidized via an omega oxidation pathway that creates odd chain units. Therefore, odd chain fatty acid accumulation may indicate carnitine deficiency and the need for supplementation.	2		68	
Nutritional Profile -> Fatty Acids -> Saturated -> Lignoceric Acid (24:0)	4		67	

Lignoceric acid, or tetracosanoic acid, is the saturated fatty acid with formula C23H47COOH. It is found in wood tar, various cerebrosides, and in small amounts in most natural fats. Accumulation of certain very long chain fatty acids (VLCFAs) is associated with degenerative diseases of the central nervous system. There are a number of genetic disorders involving accumulation of sphingolipids, usually due to the lack of enzymes necessary for the turnover of membrane VLCFAs, which include behenic (22:0), lignoceric (24:0), and hexacosanoic (26:0) acids as well as the unsaturated members of the C22-24 classes, particularly nervonic acid. The common lifestyle of low physical exertion and high fat diet sets a metabolic pattern that can lead to increasing levels of VLCFAs in plasma and erythrocyte membranes. The effect is mediated by hormonal responses, mainly norepinephrine and insulin, and is exacerbated by drugs that modulate energy metabolism such as the antianginal drug, trimetazidine.				
Nutritional Profile -> Vitamins and Minerals -> Vitamin E/Tocotrienols Vitamin E exists in eight different forms, four tocopherols and four tocotrienols. Both the tocopherols and tocotrienols occur in a (alpha), ß (beta), g (gamma) and d (delta) forms. Vitamin E in all of its forms functions as an antioxidant. The current commercial sources of tocotrienol are rice, palm, and annatto. Other natural tocotrienol sources include rice bran oil, coconut oil, cocoa butter, barley, and wheat germ. Sunflower, peanut, walnut, sesame, and olive oils, contain only tocopherols. Various studies have shown that alpha-tocopherol interferes with tocotrienol benefits. Studies suggest that the tocotrienols are more potent than tocopherpols in their antioxidant effects.	5		65	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Aspartic Acid Aspartate is non-essential in mammals, being produced from oxaloacetate by transamination. It can also be generated from ornithine and citrulline in the urea cycle. Aspartate is also a metabolite in the urea cycle and participates in gluconeogenesis. It carries reducing equivalents in the malate-aspartate shuttle, which utilizes the ready interconversion of aspartate and	12		63	

oxaloacetate, which is the oxidized (dehydrogenated) derivative of malic acid. Low - inhibits ammonia detoxification in the urea cycle. Can be converted to oxaloactetate using B6 and a-KG and thus enter the Krebs cycle. Low levels can reflect decreased cellular energy generation, seen as fatigue. Citric and aspartic acids can drive the Krebs (citric acid) cycle, when combined with B6 and a-KG. High - sometimes seen in epilepsy and stroke. Magnesium and zinc may counteract high levels.				
Nutritional Profile -> Fatty Acids -> Odd Chain -> Heptadecanoic Acid (17:0) Heptadecanoic acid, or margaric acid, is a saturated fatty acid. Its molecular formula is CH3(CH2)15COOH. It occurs as a trace component of the fat and milkfat of ruminants, but it does not occur in any natural animal or vegetable fat at high concentrations. Fatty acids with odd numbers of carbon atoms are produced primarily by initiating the synthetic series with the three carbon compound, propionic acid. Vitamin B12 is required for the conversion of propionate into succinate for oxidation in the central energy pathways. Deficiency of vitamin B12 results in accumulation of propionate and subsequent buildup of the odd numbered fatty acids, pentadecanoic (15:0), heptadecanoic (17:0), nonadecanoic (19:0), heneicosanoic (21:0), and tricosanoic (23:0) acids. The bacteria in the gut of ruminants (grazing animals like cows and sheep) produce large amounts of propionate, which is absorbed and enters the metabolism of the animal. High intake of animal and dairy products favor high levels of these fatty acids. Alternatively, it is possible that the bacteria in the human gut could produce sufficient amounts of propionate to lead to elevation in the odd-carbon fatty acids. This would only occur under conditions of significant gut dysbiosis. Carnitine is required for fatty acid oxidation. In carnitine insufficiency, fatty acids are oxidized via an omega oxidation pathway that creates odd chain units. Therefore, odd chain fatty acid accumulation may indicate carnitine deficiency and the need for supplementation.	2		63	

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Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Conditionally Essential Amino Acids -> Glutamine Glutamine is synthesized by the enzyme glutamine synthetase from glutamate and ammonia. Glutamate is a key compound in cellular metabolism. In humans, dietary proteins are broken down by digestion into amino acids, which serve as metabolic fuel for other functional roles in the body. A key process in amino acid degradation is transamination, in which the amino group of an amino acid is transferred to an a-ketoacid, typically catalysed by a transaminase. A very common a-keto acid is a-ketoglutarate, an intermediate in the citric acid cycle. Transamination of a-ketoglutarate gives glutamate. The resulting a-ketoacid product is often a useful one as well, which can contribute as fuel or as a substrate for further metabolism processes. Low - deficient intake or absorption of essential amino acids (glutamine is derived fiom histidine). Check overall amino acid level of diet. High - marker of vitamin B6 deficiency. Ammonia accumulation suspected, if low or low normal glutamic acid. Extra a-KG needed to combine with ammonia and to make up for energy deficit caused by overutilization of a-KG to deal with toxic ammonia levels.	10		61	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Sarcosine Sarcosine, also known as N-methylglycine, is an intermediate and byproduct in glycine synthesis and degradation. Sarcosine is found naturally as an intermediate in the metabolism of choline to glycine. Sarcosine is formed from dietary intake of choline and from the metabolism of methionine, and is rapidly degraded to glycine, which, in addition to its importance as a constituent of protein, plays a significant role in various physiological processes as a prime metabolic source of components of living cells such as glutathione, creatine, purines and serine. Elevated levels may indicated a functional B2 deficiency.	9		61	
Nutritional Profile -> Vitamins and Minerals -> Vitamin B12 Cobalamin B12 plays important roles in energy production from fats & proteins, methylation, synthesis of hemoglobin & RBCs, and maintenance of nerve cells, DNA & RNA. Low B12 may result from alcoholism, malabsorption, hypochlorhydria (e.g., from atrophic gastritis, H.	6		59	

pylori infection, pernicious anemia, H2 blockers, PPIs), vegan diets, diabetic meds, cholestyramine, chloramphenicol, neomycin or colchicine. B12 deficiency can lead to anemia, fatigue, neurologic symptoms (e.g., paresthesias, memory loss, depression, dementia), methylation defects or chromosome breaks. Food sources include shellfish, red meat poultry, fish, eggs, milk and cheese, nutritional yeast.				
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Conditionally Essential Amino Acids -> Glycine Glycine is not essential to the human diet, as it is biosynthesized in the body from the amino acid serine, which is in turn derived from 3-phosphoglycerate, but the metabolic capacity for glycine biosynthesis does not satisfy the need for collagen synthesis. The principal function of glycine is as a precursor to proteins, such as its periodically repeated role in the formation of the collagen helix in conjunction with hydroxyproline. Glycine is an inhibitory neurotransmitter in the central nervous system, especially in the spinal cord, brainstem, and retina. When glycine receptors are activated, chloride enters the neuron via ionotropic receptors, causing an Inhibitory postsynaptic potential (IPSP). Strychnine is a strong antagonist at ionotropic glycine receptors, whereas bicuculline is a weak one. Glycine is a required co-agonist along with glutamate for NMDA receptors. In contrast to the inhibitory role of glycine in the spinal cord, this behaviour is facilitated at the (NMDA) glutamatergic receptors which are excitatory. Low - possible generalized tissue loss, glycine being part of the nitrogen pool and important in gluconeogenesis. Supplement glycine. High - supplement vitamin B5, folic acid, and vitamins B6, and B2 for the efficient metabolism of glycine to pyruvic acid for oxidation and for glutathione synthesis or gluconeogenesis.	10		56	
Nutritional Profile -> Fatty Acids -> Ratios -> AA/EPA (Omega-6/Omega-3) Ratio AA and EPA are the most critical fatty acids for maintaining the ratio of the omega-6 and omega-3 classes because they compete for enzymes that make cell regulators. A high ratio indicates an overabundance of the pro-inflammatory, omega-6 fatty acid, AA. An overabundance of AA is quite	4		54	

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common in Western high meat and corn oil diets and can result in an imbalance in the AA/EPA ratio. This is one of the indicators that extra omega-3 fatty acids, including EPA of fish oils, would be beneficial.				
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Beta Alanine ß-Alanine is not used in the biosynthesis of any major proteins or enzymes. It is formed in vivo by the degradation of dihydrouracil and carnosine. It is a component of the naturally occurring peptides carnosine and anserine and also of pantothenic acid (vitamin B5), which itself is a component of coenzyme A. Under normal conditions, ß-alanine is metabolized into acetic acid. ß-Alanine is the rate-limiting precursor of carnosine, which is to say carnosine levels are limited by the amount of available ß-alanine, not histidine.[3] Supplementation with ß-alanine has been shown to increase the concentration of carnosine in muscles, decrease fatigue in athletes and increase total muscular work done. Elevated levels suggest possible bowel toxicity due to ß-alanine production by intestinal bacteria and/or Candida albicans. Possible cause for food sensitivity reactions when combined with low taurine and high 3-methylhistidine, carnosine and/or anserine, due to impaired renal tubular resorption. Supplement B6(to facilitate amine group transfer). Bowel detox or high potency Lactobacillus acidophilus and Bifidobacteria can assist with dysbiosis.	9		54	
Nutritional Profile -> Vitamins and Minerals -> Molybdenum Molybdenum is a cofactor for enzymes that convert sulfites to sulfate, and nucleotides to uric acid, and that help metabolize aldehydes & other toxins. Low Mo levels may result from long-term TPN that does not include Mo. Mo deficiency may result in increased sulfite, decreased plasma uric acid (and antioxidant function), deficient sulfate, impaired sulfation (detoxification), neurologic disorders or brain damage (if severe deficiency). Food sources include buckwheat, beans, grains, nuts, beans, lentils, meats and vegetables (although Mo content of plants depends on soil content).	11		53	
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Limiting Amino Acids -> Tryptophan	8		53	

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Tryptophan is an amino acid needed for normal growth in infants and for nitrogen balance in adults. It is an essential amino acid. The body uses tryptophan to help make niacin and serotonin. Serotonin is thought to produce healthy sleep and a stable mood. Low levels commonly correlated with depression, insomnia, and schizophrenia. Supplementation with 5-Hydroxytryptophan (5-HTP) may help. High levels suggest inadequate metabolism of tryptophan. Required nutrients for this process include niacin, riboflaving, iron, and vitamin B6.				
Nutritional Profile -> Fatty Acids -> Ratios -> Stearic/Oleic Ratio The stearic acid/oleic acid ratio from red blood cells may be a marker for the presence of malignant tissue, particularly with prostate cancer. In tumors, the net result of changes in fatty acid metabolism is low stearic acid and high oleic acid, causing a profound shift in the ratio of stearic to oleic acids. One likely outcome of this shift is increased fluidity of the tumor cell membrane, resulting in more rapid movement of nutrients and waste products and allowing for faster metabolic rate.	6		51	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Glutamic Acid Glutamic acid and a-ketoglutarate, an intermediate in the Krebs cycle, are interconvertible by transamination. Glutamic acid can therefore enter the Krebs cycle for energy metabolism, and be converted by the enzyme glutamine synthetase into glutamine, which is one of the key players in nitrogen metabolism. Glutamate is a key compound in cellular metabolism. In humans, dietary proteins are broken down by digestion into amino acids, which serve as metabolic fuel for other functional roles in the body. A key process in amino acid degradation is transamination, in which the amino group of an amino acid is transferred to an a-ketoacid, typically catalysed by a transaminase. A very common a-keto acid is a-ketoglutarate, an intermediate in the citric acid cycle. Transamination of a-ketoglutarate gives glutamate. The resulting a-ketoacid product is often a useful one as well, which can contribute as fuel or as a substrate for further metabolism processes. Low - can suggest mild hyper-ammonemia, especially if high glutamine. Low protein, high complex carbohydrate and B6, a-KG and BCAA's suggested to correct ammonia toxicity.	6		51	

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High - possible underconversion to a-KG in liver for use in citric add cycle. Supplement niacin and B6.				
Nutritional Profile -> Vitamins and Minerals -> Vitamin B5 Pantothenic Acid Pantothenic acid, also called vitamin B5 (a B vitamin), is a water-soluble vitamin. Pantothenic acid is an essential nutrient. Animals require pantothenic acid to synthesize coenzyme-A (CoA), as well as to synthesize and metabolize proteins, carbohydrates, and fats. The vitamin's name derives from the Greek word pantothen, meaning 'from everywhere,' reflecting the fact that small amounts of pantothenic acid can be found in nearly every food. Dietary sources avocado, whole-grain cereals, legumes, eggs, meat, royal jelly, and yogurt.	11		50	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 6 -> Linoleic Acid (18:2n6) Linoleic acid belongs to one of the two families of essential fatty acids, which means that the human body cannot synthesize it from other food components. The word 'linoleic' derived from the Greek word linon (flax). Oleic means 'of, relating to, or derived from oil of olive' or 'of or relating to oleic acid' because saturating the omega-6 double bond produces oleic acid. LA is a polyunsaturated fatty acid used in the biosynthesis of arachidonic acid (AA) and thus some prostaglandins, leukotrienes (LTA, LTB, LTC), and thromboxane (TXA). It is found in the lipids of cell membranes. It is abundant in many nuts, fatty seeds (flax seeds, hemp seeds, poppy seeds, sesame seeds, etc.) and their derived vegetable oils; comprising over half (by weight) of poppy seed, safflower, sunflower, corn, and soybean oils. Linoleic acid (18:2n6) is by far the most abundant polyunsaturated fatty acid in most human tissues. Linoleic acid (LA) is an essential fatty acid, and low levels indicate dietary insufficiency, which can lead to a variety of symptoms. Some of these symptoms result from lack of LA in membranes, where it plays a role in structural integrity. Most, however, are from failure to produce eicosanoids, which are cell regulators. LA is the starting point for this pathway. Normal neonatal status of this fatty acid is marginal, if not insufficient. Since dietary sources (especially corn oil) are abundant, however, LA may be found above normal. Excessive LA can contribute to inflammation.	9		49	

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Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Branched Chain Amino Acids -> Leucine Leucine is used in the liver, adipose tissue, and muscle tissue. Adipose and muscle tissue use leucine in the formation of sterols. Combined leucine use in these two tissues is seven times greater than in the liver. Leucine is an mTOR activator. It is a dietary amino acid with the capacity to directly stimulate muscle protein synthesis. Low levels suggest potential catabolism of skeletal muscle. Check 3-Methylhistidine to confirm. Elevated levels correlate with large intake or incomplete metabolism. If other BCAAs are high, add vitamin B6.	7		49	
Nutritional Profile -> Vitamins and Minerals -> Vitamin B3 Niacin B3 is used to form NAD and NADP, involved in energy production from food, fatty acid & cholesterol synthesis, cell signaling, DNA repair & cell differentiation. Low B3 may result from deficiencies of tryptophan (B3 precursor), B6, B2 or Fe (cofactors in B3 production), or from long-term isoniazid or oral contraceptive use. B3 deficiency may result in pellagra (dermatitis, diarrhea, dementia), neurologic symptoms (e.g., depression, memory loss), bright red tongue or fatigue. Food sources include poultry, beef, organ meats, fish, whole grains, peanuts, seeds, lentils, brewer's yeast and lima beans.	12		47	
Nutritional Profile -> Fatty Acids -> Monounsaturated -> Vaccenic Acid (18:1n7) Vaccenic acid (18:1n7) is a positional isomer of oleic acid – they have the same number of carbon molecules but the double bond is shifted. Vaccenic acid plays a role in maintaining membrane fluidity. It is a naturally occurring trans-fatty acid found in the fat of ruminants and in dairy products such as milk, butter, and yogurt. It is also the predominant fatty acid comprising trans fat in human milk.	1		41	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 6 -> Dihomogamma Linoleic Acid (20:3n6) DGLA is made in the body by the elongation of GLA, by an efficient enzyme which does not appear to suffer any form of (dietary) inhibition. Low levels of dihomogamma-linolenic acid (20:3n6) result from diets low	1		40	

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in both essential fatty acids, LA, and dihomogamma-linolenic acid (DGLA). DGLA is also anti-inflammatory, so an insufficiency of this fatty acid impairs a wide range of cellular functions and tissue responses. When testing reveals low levels of DGLA, supplementation with black currant or evening primrose oils should be considered.				
Nutritional Profile -> Fatty Acids -> Saturated -> Lauric Acid (12:0) Lauric acid, as a component of triglycerides, comprises about half of the fatty acid content in coconut milk, coconut oil, laurel oil, and palm kernel oil. Capric (10:0), lauric (12:0), and myristic (14:0) acids, the medium chain fatty acids (MCFAs), are present in small amounts in plant oils and butter. The MCFAs are virtually nonexistent in meats because animals oxidize them very rapidly from plants consumed, and do not accumulate in the tissues. Various "medium chain triglyceride" products have become available for lipid digestive disorders and have found use in athletic training. They contain MCFAs that are assimilated rapidly without the normal bile acid dispersal requirement. In human tissues, capric, lauric, and myristic acids are oxidized by peroxisomal oxidative pathways to a larger extent than the longer chain fatty acids. Elevated levels could indicate general suppression of peroxisomal oxidation which utilizes riboflavin-derived cofactors.	6		40	
Nutritional Profile -> Fatty Acids -> Odd Chain -> Nonadecanoic Acid (19:0) Nonadecylic acid can be found in fats and vegetable oils. It is also used by insects as pheromones. Fatty acids with odd numbers of carbon atoms are produced primarily by initiating the synthetic series with the three carbon compound, propionic acid. Vitamin B12 is required for the conversion of propionate into succinate for oxidation in the central energy pathways. Deficiency of vitamin B 12 results in accumulation of propionate and subsequent buildup of the odd numbered fatty acids, pentadecanoic (15:0), heptadecanoic (17:0), nonadecanoic (19:0), heneicosanoic (21:0), and tricosanoic (23:0) acids.	5		39	

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The bacteria in the gut of ruminants (grazing animals like cows and sheep) produce large amounts of propionate, which is absorbed and enters the metabolism of the animal. High intake of animal and dairy products favor high levels of these fatty acids. Alternatively, it is possible that the bacteria in the human gut could produce sufficient amounts of propionate to lead to elevation in the odd-carbon fatty acids. This would only occur under conditions of significant gut dysbiosis. Carnitine is required for fatty acid oxidation. In carnitine insufficiency, fatty acids are oxidized via an omega oxidation pathway that creates odd chain units. Therefore, odd chain fatty acid accumulation may indicate carnitine deficiency and the need for supplementation.				
Nutritional Profile -> Fatty Acids -> Monounsaturated -> Palmitoleic Acid (16:1n7) An omega-7 monounsaturated fatty acid that is a common constituent of the glycerides of human adipose tissue. It is present in all tissues but found in higher concentrations in the liver. It is biosynthesized from palmitic acid by the action of the enzyme delta-9 desaturase. A beneficial fatty acid, it has been shown to increase insulin sensitivity by suppressing inflammation, as well as inhibit the destruction of insulin-secreting pancreatic beta cells. Macadamia oil (Macadamia integrifolia) and sea buckthorn oil (Hippophae rhamnoides) are botanical sources with high concentrations, containing 17% and 19-29% of palmitoleic acid, respectively. Palmitoleic acid (16:1n7) is the desaturation product of palmitic acid. Since palmitic acid is predominant in human tissues where desaturase enzyme activity is present, one might expect relatively high levels of palmitoleic acid. Such levels are not found in healthy humans. Palmitoleic acid formation is increased only when intake of essential fatty acids is low. Thus, high palmitoleic acid is a marker of essential fatty acid deficiency.	10	[redacted]	38	
Nutritional Profile -> Vitamins and Minerals -> Vitamin C Vitamin C is an antioxidant and also used in the regeneration of other antioxidants. It is involved in cholesterol metabolism, the production & function of WBCs and antibodies, and the synthesis of collagen, norepinephrine and carnitine. Deficiency may occur with oral contraceptives, aspirin, diuretics or NSAIDs. Deficiency can result in scurvy, swollen gingiva, periodontal	10	[redacted]	36	

destruction, loose teeth, sore mouth, soft tissue ulcerations, or increased risk of infection. Food sources include oranges, grapefruit, strawberries, tomato, sweet red pepper, broccoli and potato				
Nutritional Profile -> Fatty Acids -> Trans -> Palmitelaidic Acid (16:1n7t) Palmitelaidic acid is a trans fatty acid (the trans isomer of palmitoleic acid). Trans fatty acids are known to cause changes in plasma lipids and lipoprotein phenotypes, but the mechanisms involved are unknown. The major dietary sources of trans fatty acids are partly hydrogenated vegetable oils, mainly elaidic acid.	8		34	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> 1-Methylhistidine 1-methylhistidine (1-MHis) is derived mainly from the anserine of dietary flesh sources, especially poultry. The enzyme, carnosinase, splits anserine into b-alanine and 1-MHis. High levels of 1-MHis tend to inhibit the enzyme carnosinase and increase anserine levels. Conversely, genetic variants with deficient carnosinase activity in plasma show increased 1-MHis excretions when they consume a high meat diet. Vitamin E deficiency can lead to 1-methylhistidinuria from increased oxidative effects in skeletal muscle. High levels can indicated impaired methionine metabolism. Consider B12, folate, DMG, and/or zinc.	8		34	
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Limiting Amino Acids -> Lysine A systematic Cochrane Review (investigating all clinical trials, in vitro studies and mechanism of action) published in 2015 showed there is no evidence that lysine supplementation is effective against herpes simplex virus and it has not been approved by the FDA for herpes simplex suppression. Lysine has anxiolytic action through its effects on serotonin receptors in the intestinal tract, and is also hypothesized to reduce anxiety through serotonin regulation in the amygdala. Lysine, acting as a serotonin antagonist and therefore reducing the overactivity of these receptors, reduced signs of anxiety and anxiety-induced diarrhea in the sample population. Another study showed that lysine deficiency leads to a pathological increase in serotonin in the amygdala, a brain structure that is involved in emotional regulation and the stress response. Human studies have also shown correlations between reduced lysine intake and anxiety. A population-based study in Syria included 93 families whose diet is primarily grain-based and therefore likely to be deficient in	9		33	

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lysine. Fortification of grains with lysine was shown to reduce markers of anxiety, including cortisol levels; Smiriga and colleagues hypothesized that anxiety reduction from lysine occurs through mechanism of serotonin alterations in the central amygdala; older primary research reports hypothesized lysine to reduce anxiety through the potentiation of benzodiazepine receptors (common targets of anxiolytic drugs such as Xanax and Ativan)				
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Branched Chain Amino Acids -> Isoleucine Inability to break down isoleucine, along with other amino acids, is associated with Maple Syrup Urine Disease, which results in discoloration and a sweet smell in the patient's urine. Low levels indicate a chronic deficiency of this AA and can cause hypoglycemia and related problems such as loss of muscle mass or inability to build muscle. High levels suggest a large intake of this AA or incomplete metabolism of it. If other BCAAs are high, add vitamin B6 to aid metabolism.	8		33	
Nutritional Profile -> Fatty Acids -> Monounsaturated -> Oleic Acid (18:1n9) Oleic acid (18:1n9) is present in the fat of all foods and is also produced from essential fatty acids in normal human liver cells and fat cells. Oleic acid makes up 15% of the fatty acids in the membranes of red blood cells and, because of the presence of one double bond in the center of the molecule, helps maintain critical membrane fluidity. Low levels of oleic acid have an impact on this function and can be corrected by increasing dietary intake (olive oil).	6		33	
Nutritional Profile -> Vitamins and Minerals -> Viitamin B7 Biotin Biotin is a cofactor for enzymes involved in functions such as fatty acid synthesis, mitochondrial FA oxidation, gluconeogenesis and DNA replication & transcription. Deficiency may result from certain inborn errors, chronic intake of raw egg whites, long-term TPN, anticonvulsants, high-dose B5, sulfa drugs & other antibiotics. Low levels may result in neurologic symptoms (e.g., paresthesias, depression), hair loss, scaly rash on face or genitals or impaired immunity. Food sources include yeast, whole grains, wheat germ, eggs, cheese, liver, meats, fish, wheat, nuts & seeds, avocado, raspberries, sweet potato and cauliflower.	12		32	

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Nutritional Profile -> Fatty Acids -> Odd Chain -> Heneicosanoic Acid (21:0) Heneicosylic acid, or heneicosanoic acid, is a 21-carbon long-chain saturated fatty acid with the chemical formula CH3(CH2)19COOH. Fatty acids with odd numbers of carbon atoms are produced primarily by initiating the synthetic series with the three carbon compound, propionic acid. Vitamin B12 is required for the conversion of propionate into succinate for oxidation in the central energy pathways. Deficiency of vitamin B 12 results in accumulation of propionate and subsequent buildup of the odd numbered fatty acids, pentadecanoic (15:0), heptadecanoic (17:0), nonadecanoic (19:0), heneicosanoic (21:0), and tricosanoic (23:0) acids. The bacteria in the gut of ruminants (grazing animals like cows and sheep) produce large amounts of propionate, which is absorbed and enters the metabolism of the animal. High intake of animal and dairy products favor high levels of these fatty acids. Alternatively, it is possible that the bacteria in the human gut could produce sufficient amounts of propionate to lead to elevation in the odd-carbon fatty acids. This would only occur under conditions of significant gut dysbiosis. Carnitine is required for fatty acid oxidation. In carnitine insufficiency, fatty acids are oxidized via an omega oxidation pathway that creates odd chain units. Therefore, odd chain fatty acid accumulation may indicate carnitine deficiency and the need for supplementation.	7		30	
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Conditionally Essential Amino Acids -> Cystine Formed from the oxidation of two cysteine molecules, via the formation of a disulfide bond. The presence of cystine in urine is often indicative of amino acid reabsorption defects. Low - possible dietary deficiency of methionine and/or cystine. Low cystine can impair taurine synthesis. High - excessive dietary intake or impaired cystine metabolism. Converted to cysteine (reduced cystine) via a B2 and copper-dependent step. Cystine is a major component of tissue antioxidant mechanisms.	1		30	
Nutritional Profile -> Antioxidants -> Alpha Lipoic Acid	3		29	

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a-Lipoic acid plays an important role in energy production, antioxidant activity (including the regeneration of vitamin C and glutathione), insulin signaling, cell signaling and the catabolism of a-keto acids and amino acids. High biotin intake can compete with lipoic acid for cell membrane entry. Optimal levels of a-lipoic acid may improve glucose utilization and protect against diabetic neuropathy, vascular disease and age-related cognitive decline. Main food sources include organ meats, spinach and broccoli. Lesser sources include tomato, peas, Brussels sprouts and brewer's yeast.				
Nutritional Profile -> Vitamins and Minerals -> Vitamin E/Tocopherols Vitamin E exists in eight different forms, four tocopherols and four tocotrienols. Both the tocopherols and tocotrienols occur in a (alpha), ß (beta), g (gamma) and d (delta) forms. Vitamin E in all of its forms functions as an antioxidant. Alpha-tocopherol (body's main form of vitamin E) functions as an antioxidant, regulates cell signaling, influences immune function and inhibits coagulation. Alpha-tocopherol is considered the active form because it is the preferred form of vitamin E transported and used by the liver. Deficiency may occur with malabsorption, cholestyramine, colestipol, isoniazid, orlistat, olestra and certain anti-convulsants (e.g., phenobarbital, phenytoin). Deficiency may result in peripheral neuropathy, ataxia, muscle weakness, retinopathy, and increased risk of CVD, prostate cancer and cataracts. Dietary sources include oils (olive, soy, corn, canola, safflower, sunflower), eggs, nuts, seeds, spinach, carrots, avocado, dark leafy greens and wheat germ.	6		29	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Hydroxyproline Hydroxyproline is produced by hydroxylation of the amino acid proline by the enzyme prolyl hydroxylase following protein synthesis (as a post-translational modification). The enzyme catalysed reaction takes place in the lumen of the endoplasmic reticulum. Although it is not directly incorporated into proteins, hydroxyproline comprises roughly 4% of all amino acids found in animal tissue, an amount greater than seven other amino acids that are translationally incorporated. Hydroxyproline is a major component of the protein collagen, comprising roughly 13.5% of mammalian collage	8		28	

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High - another indicator of bone resorption via collagen breakdown. Supplement as in the case of high hydroxylysine with iron, a-KG, vitamin C, chondroitin, manganese.				
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 3 -> Docosahexaenoic Acid (22:6n3) Docosahexaenoic acid (DHA) is an omega-3 fatty acid that is a primary structural component of the human brain, cerebral cortex, skin, sperm, testicles and retina. It can be synthesized from alpha-linolenic acid or obtained directly from maternal milk (breast milk), fish oil or algae oil. The growth and development of the central nervous system is particularly dependent upon the presence of an adequate amount of the very long chain, highly unsaturated fatty acids, docosapentaenoic (22:5n3) and docosahexaenoic acids (22:6n3). Attention deficit hyperactivity disorder and issues in the development of the visual system in EFA deficiencies are two examples of this dependency. Docosahexaenoic acid (DHA) is an important member of the very long chain fatty acids (C22 to C26) that characteristically occur in glycosphingolipids, particularly in the brain. Since this fatty acid is so important in early development, it is worth noting that the levels in breast milk are correlated with the mother's intake of fish oils, which are rich sources of both of these fatty acids. DHA intake may also help to lower blood pressure.	9		27	
Nutritional Profile -> Fatty Acids -> Ratios -> Triene/Tetraene Ratio The Triene/Tetraene (T/T) ratio is another marker for essential fatty acid status. It is calculated as the ratio of Mead acid to arachidonic acid. This ratio, combined with measurements of the essential fatty acids and Mead acid, gives a more complete picture of the degree and nature of fatty acid deficiency. An elevated ratio shows a relative excess of triene (3 double bonds) compared to tetraene (4 double bonds), which results from EFA deficiency.	8		26	
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Conditionally Essential Amino Acids -> Arginine	5		24	

Arginine is synthesized from citrulline in arginine and proline metabolism by the sequential action of the cytosolic enzymes argininosuccinate synthetase (ASS) and argininosuccinate lyase (ASL). In terms of energy, this is costly, as the synthesis of each molecule of argininosuccinate requires hydrolysis of adenosine triphosphate (ATP) to adenosine monophosphate (AMP), i.e., two ATP equivalents. In essence, taking an excess of arginine gives more energy by saving ATPs that can be used elsewhere. On a whole-body basis, synthesis of arginine occurs principally via the intestinal–renal axis, wherein epithelial cells of the small intestine, which produce citrulline primarily from glutamine and glutamate, collaborate with the proximal tubule cells of the kidney, which extract citrulline from the circulation and convert it to arginine, which is returned to the circulation. As a consequence, impairment of small bowel or renal function can reduce endogenous arginine synthesis, thereby increasing the dietary requirement. Arginine plays an important role in cell division, the healing of wounds, removing ammonia from the body, immune function, and the release of hormones. Low - often reflects a diet poor in high quality protein, causing arginine to be poorly absorbed. Because arginine is required for nitric oxide production, deficiencies have wide-ranging effects on cardiovascular and other systems. High - may indicate a functional block in the urea cycle. Manganese activates an arginase enzyme, so supplementing with maganese may be useful.				
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Conditionally Essential Amino Acids -> Taurine Taurine has many fundamental biological roles, such as conjugation of bile acids, antioxidation, osmoregulation, membrane stabilization, and modulation of calcium signaling. It is essential for cardiovascular function, and development and function of skeletal muscle, the retina, and the central nervous system. Taurine is unusual among biological molecules in being a sulfonic acid, while the vast majority of biologically occurring acids contain the more weakly acidic carboxyl group. While taurine is sometimes called an amino acid, and indeed is an acid containing an amino group, it is not an amino acid in the usual biochemical meaning of the term, which refers to compounds containing both an amino and a carboxyl group.	3		23	

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Low - may increase risk for oxidative stress, fat maldigestion, high cholesterol, atherosclerosis, angina, arrythmias, and seizure disorders. Supplement taurine or cysteine and vitamin B6, even if fresh fish or lean meat is eaten. Females do not synthesize taurine as easily as males. High - may be due to excessive inflammation in the body or to supplementation of other amino acids.				
Nutritional Profile -> Vitamins and Minerals -> Vitamin K2 Vitamin K is a group of structurally similar, fat-soluble vitamins the human body requires for complete synthesis of certain proteins that are prerequisites for blood coagulation that the body needs for controlling binding of calcium in bones and other tissues. Bacteria in the colon convert K1 into vitamin K2. In addition, bacteria typically lengthen the isoprenoid side chain of vitamin K2 to produce a range of vitamin K2 forms, most notably the MK-7 to MK-11 homologues of vitamin K2. Low levels may indicate intestinal dysbiosis.	9		20	
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Conditionally Essential Amino Acids -> Proline Proline, also known as L-proline, is an amino acid. It is non-essential because it can be synthesized by the body through the breakdown of L-glutamate, another amino acid. Proline is responsible for tissue repair, collagen formation, arteriosclerosis prevention and blood pressure maintenance. Hydroxyproline and proline play key roles for collagen stability. They permit the sharp twisting of the collagen helix. L-Proline has been found to act as a weak agonist of the glycine receptor and of both NMDA and non-NMDA (AMPA/kainate) ionotropic glutamate receptors. Proline is a phosphorylation marker and is commonly found right before the amino acid serine and threonine to mark them as phosphorylation spots. As a result, Proline preceding these amino acids in an amino acid chain is highly evolutionarily conserved.	2		18	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Alanine Alanine is most commonly produced by reductive amination of pyruvate. Because transamination reactions are readily reversible and pyruvate pervasive, alanine can be easily formed and thus has close links to metabolic pathways such as glycolysis, gluconeogenesis, and the citric acid	10		17	

cycle. It also arises together with lactate and generates glucose from protein via the alanine cycle. Low - may point to hypoglycemic conditions because of its role in gluco- neogenesis. Supplement with alanine and the branched chain amino acids leucine, isoleucine and valine. High - possible inadequate cellular energy substrates. Check for hypoglycemia or for exercise prior to blood draw. Chronic use of alanine for energy can lead to muscle wasting. Supplement the branched-chain aminos.				
Nutritional Profile -> Fatty Acids -> Saturated -> Myristic Acid (14:0) Nutmeg butter has 75% trimyristin, the triglyceride of myristic acid. Besides nutmeg, myristic acid is also found in palm kernel oil, coconut oil, butter fat and is a minor component of many other animal fats. It is also found in spermaceti, the crystallized fraction of oil from the sperm whale. Capric (10:0), lauric (12:0), and myristic (14:0) acids, the medium chain fatty acids (MCFAs), are present in small amounts in plant oils and butter. The MCFAs are virtually nonexistent in meats because animals oxidize them very rapidly from plants consumed, and do not accumulate in the tissues. Various "medium chain triglyceride" products have become available for lipid digestive disorders and have found use in athletic training. They contain MCFAs that are assimilated rapidly without the normal bile acid dispersal requirement. In human tissues, capric, lauric, and myristic acids are oxidized by peroxisomal oxidative pathways to a larger extent than the longer chain fatty acids. Elevated levels could indicate general suppression of peroxisomal oxidation which utilizes riboflavin-derived cofactors.	11		15	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 6 -> Docosadienoic Acid (22:2n6) Docosadienoic acid (22:2n6) is a very long-chain fatty acid (VLCFA). It is the elongation product of DGLA. Elevated levels of docosadienoic acid should appear only under conditions of dietary adequacy of LA and DGLA, together with stimulation of elongation. The latter is one effect of insulin resistance.	10		15	

When omega-6 dietary fatty acids are consumed in abundance, there is an accumulation of desaturation and elongation intermediates. Diets high in fat and simple sugars contribute to obesity and to the accumulation of docosatetraenoic acid (22:4n).				
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Carnosine Carnosine (beta-alanyl-L-histidine) is a dipeptide of the amino acids beta-alanine and histidine. It is highly concentrated in muscle and brain tissues. Carnosine has been proven to scavenge reactive oxygen species (ROS) as well as alpha-beta unsaturated aldehydes formed from peroxidation of cell membrane fatty acids during oxidative stress. Carnosine is also a zwitterion, a neutral molecule with a positive and negative end. Elevated levels suggest deficiency of enzyme carnosinase or its cofactor, zinc. This analyte is a ß-alanyl dipeptide of histidine. Inherited carnosinase enzyme deficits lead to neurological development problems and sensory polyneuropathy.	6		14	
Nutritional Profile -> Fatty Acids -> Saturated -> Behenic Acid (22:0) At 9%, it is a major component of Ben oil (or behen oil), which is extracted from the seeds of the Ben-oil tree (Moringa oleifera). Behenic acid is also present in some other oils and oil-bearing plants, including rapeseed (canola) and peanut oil and skins. As a dietary oil, behenic acid is poorly absorbed. In spite of its low bioavailability compared with oleic acid, behenic acid is a cholesterol-raising saturated fatty acid in humans. Accumulation of certain very long chain fatty acids (VLCFAs) is associated with degenerative diseases of the central nervous system. There are a number of genetic disorders involving accumulation of sphingolipids, usually due to the lack of enzymes necessary for the turnover of membrane VLCFAs, which include behenic (22:0), lignoceric (24:0), and hexacosanoic (26:0) acids as well as the unsaturated members of the C22-24 classes, particularly nervonic acid. The common lifestyle of low physical exertion and high fat diet sets a metabolic pattern that can lead to increasing levels of VLCFAs in plasma and erythrocyte membranes. The effect is mediated by hormonal responses, mainly norepinephrine and insulin, and is exacerbated by drugs that modulate energy	6		13	

metabolism such as the antianginal drug, trimetazidine.				
Nutritional Profile -> Vitamins and Minerals -> Vitamin K1 Vitamin K is a group of structurally similar, fat-soluble vitamins the human body requires for complete synthesis of certain proteins that are prerequisites for blood coagulation that the body needs for controlling binding of calcium in bones and other tissues. Vitamin K1, also known as phylloquinone, phytomenadione, or phytonadione, is synthesized by plants, and is found in highest amounts in green leafy vegetables because it is directly involved in photosynthesis. It may be thought of as the 'plant' form of vitamin K. Low levels suggest a low intake of green leafy vegetables.	11		11	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Gamma-aminobutyric acid (GABA) Gamma-aminobutyric acid: the chief inhibitory neurotransmitter in the mammalian central nervous system. It plays the principal role in reducing neuronal excitability throughout the nervous system. In humans, GABA is also directly responsible for the regulation of muscle tone. Although in chemical terms it is an amino acid, GABA is rarely referred to as such in the scientific or medical communities, because the term 'amino acid,' used without a qualifier, by convention refers to the alpha amino acids, which GABA is not, nor is it considered to be incorporated into proteins. High - may reflect decreased ability to convert to succinate for use in the Krebs (citric acid) cycle for energy generation. Cofactors are a-KG and vitamin B6.	9		11	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 9 -> Mead Acid (20:3n9) Mead acid is an omega-9 fatty acid, first characterized by James F. Mead. As with some other omega-9 polyunsaturated fatty acids, animals can make Mead acid de novo. Its elevated presence in the blood is an indication of essential fatty acid deficiency. Mead acid is found in large quantities in cartilage. Mead acid (20:3n9) is a marker for overall, essential fatty acid status. It is produced in human tissues from oleic acid and, therefore, is not considered essential. The essential fatty acids, linoleic and alpha linolenic, prevent Mead acid formation in individuals with good dietary fat intake. When	2		11	

essential fatty acids are depleted, higher levels of Mead acid are detected. During essential fatty acid deficiency, Mead acid serves as a structural component in cell membranes as a substitute for the normal polyunsaturated fatty acids derived from essential precursors. It cannot substitute, however, in the critical role of precursor to eicosanoid cell regulators. Mead acid formulation may also be stimulated by high intake of omega 3 fatty acids.				
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Branched Chain Amino Acids -> Valine Valine, as well as other branched-chain amino acids, are associated with insulin resistance, as higher levels of valine are observed in the blood of diabetic mice, rats, and humans. Low levels in Valine or other BCAAs indicates potential muscle loss. If several essential AAs are low, check for adequate stomach acid. Supplement the BCAAs. High levels correlated with excessive intake or vitamin B 6 functional deficit.	12		9	
Nutritional Profile -> Fatty Acids -> Saturated -> Arachidic Acid (20:0) Arachidic acid, also known as eicosanoic acid, is a saturated fatty acid with a 20-carbon chain. It is as a minor constituent of cupuaçu butter (7%), peanut oil (1.1%–1.7%), corn oil (3%), and cocoa butter (1%). Arachidic acid (20:0), the elongation product of stearic acid, can be utilized as an energy source to build membranes. Its accumulation can interfere with essential fatty acid metabolism, as it inhibits the delta 6 desaturase enzyme needed to produce DGLA, EPA, and AA. It can be formed by the hydrogenation of arachidonic acid.	1		8	
Nutritional Profile -> Vitamins and Minerals -> Vitamin B2 Riboflavin B2 is a key component of enzymes involved in antioxidant function, energy production, detoxification, methionine metabolism and vitamin activation. Low B2 may result from chronic alcoholism, some anti-psychotic medications, oral contraceptives, tricyclic antidepressants, quinacrine or adriamycin. B2 deficiency may result in oxidative stress, mitochondrial dysfunction, low uric acid, low B3 or B6, high homocysteine, anemia or oral & throat inflammation. Food sources include milk, cheese, eggs, whole grains, beef, chicken, wheat	12		6	

germ, fish, broccoli, asparagus, spinach, mushrooms and almonds.				
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Hydroxylysine Hyroxylysine arises from a post-translational hydroxy modification of lysine. It is most widely known as a component of collagen. High - indicative of connective and bone tissue breakdown. Collagen synthesis requires iron, a-KG and vitamin C. Supplementation of these plus chondroitin sulfate and manganese are extremely helpful.	2		5	
Nutritional Profile -> Vitamins and Minerals -> Vitamin B6 Pyridoxine B6 (as P5P) is a cofactor for enzymes involved in glycogenolysis & gluconeo- genesis, and synthesis of neurotransmitters, heme, B3, RBCs and nucleic acids. Low B6 may result from chronic alcoholism, long-term diuretics, estrogens (oral contraceptives and HRT), anti-TB meds, penicillamine, L-DOPA or digoxin.B6 deficiency may result in neurologic symptoms (e.g., irritability, depression, seizures), oral inflammation, impaired immunity or increased homocysteine.Food sources include poultry, beef, beef liver, fish, whole grains, wheat germ, soybean, lentils, nuts & seeds, potato, spinach and carrots.	9		5	
Nutritional Profile -> Fatty Acids -> Trans -> Total C:18 Trans The trans fatty acids are prevalent in most diets because of the widespread use of hydrogenated oils used by manufacturers of margarines, bakery products, and peanut butters. Palmitelaidic acid (16:1:7t) is the shorter and less abundant member of the trans fats, because oils used in hydrogenation contain very little of its precursor, palmitoleic acid. The total C18 trans isomers include elaidic acid, petroselaidic, and trans-vaccenic acids. The presence of these eighteen-carbon long trans fatty acids in human tissue can disrupt or impair cell membrane function. A patient with high levels of total C18 trans isomers should be told to avoid hydrogenated oils.These fatty acids contain one double bond and thus are included in the unsaturated category. Because of the geometry of the trans bond, however, they behave like saturated fats on the one hand, leading to elevated cholesterol levels. On the other hand they mimic unsaturated fats that bindto desaturase enzymes and	6		5	

antagonize the normal production of necessary products. The net effect is to raise plasma LDL cholesterol and lower HDL. It is now the consensus among experts in lipid nutrition that foods containing hydrogenated oils are to be avoided. These fatty acids are also produced by the bacteria in the gut of ruminant animals which is the reason that beef and milk contain small amounts (13%) of elaidic acid. Moderate use of these foods is unlikely to provide trans fatty acids at levels that are of concern.				
Nutritional Profile -> Antioxidants -> CoQ10 CoQ10 is a powerful antioxidant that is synthesized in the body and contained in cell membranes. CoQ10 is also essential for energy production &pH regulation CoQ10 deficiency may occur with HMG-CoA reductase inhibitors (statins), several anti-diabetic medication classes (biguanides, sulfonylureas) or beta-blockers. Main food sources include meat, poultry, fish, soybean, canola oil, nuts and whole grains. Moderate sources include fruits, vegetables, eggs and dairy. Sardines are particularly high in CoQ10.	12		3	
Nutritional Profile -> Fatty Acids -> Saturated -> Palmitic Acid (16:0) The most common fatty acid (saturated) found in animals, plants and microorganisms. As its name indicates, it is a major component of the oil from palm trees (palm oil), but can also be found in meats, cheeses, butter, and dairy products. Excess carbohydrates in the body are converted to palmitic acid. Palmitic acid is the first fatty acid produced during fatty acid synthesis and the precursor to longer fatty acids. The liver can convert fatty acids into cholesterol. Although any fatty acid can enter this pathway, palmitic acid (16:0) is the most stimulatory one known. Palmitic acid is high in palm kernel and coconut oils. High levels can lead to increased serum cholesterol and increased risk of atherosclerosis, cardiovascular disease, and stroke. In contrast to saturated fatty acids, unsaturated fatty acids cause either no reaction or actually lower serum cholesterol (as in the case of EPA).	10		3	
Nutritional Profile -> Fatty Acids -> Polyunsaturated Omega 6 -> Arachidonic Acid (20:4n6)	12		2	

Arachidonic acid is a polyunsaturated fatty acid present in the phospholipids (especially phosphatidylethanolamine, phosphatidylcholine, and phosphatidylinositides) of membranes of the body's cells, and is abundant in the brain, muscles, and liver. Skeletal muscle is an especially active site of arachidonic acid retention, accounting for roughly 10-20% of the phospholipid fatty acid content on average. In addition to being involved in cellular signaling as a lipid second messenger involved in the regulation of signaling enzymes, arachidonic acid is a key inflammatory intermediate and can also act as a vasodilator. Under normal metabolic conditions, increased consumption of arachidonic acid will not cause inflammation unless lipid peroxidation products are mixed in. Because of the prevalence of corn and corn oil products in feed for cattle and hogs, diets high in these red meats are rich in arachidonic acid (20:4n6). Arachidonic acid (AA) is a 20-carbon or fatty acid that serves as the principal pro-inflammatory fatty acid. Its synthesis is inhibited by non-steroidal anti-inflammatory drugs (NSAIDs). High AA promotes gallstone formation by stimulating mucin production in the gallbladder mucosa.				
Nutritional Profile -> Fatty Acids -> Monounsaturated -> 11-Eicosenoic Acid (20:1n9) 11-Eicosenoic acid, also called Gondoic acid, is a monounsaturated omega-9 fatty acid found in a variety of plant oils and nuts; in particular jojoba oil. It is the elongation product of oleic acid.	12		1	
Nutritional Profile -> Vitamins and Minerals -> Manganese Manganese plays an important role in antioxidant function, gluconeogenesis, the urea cycle, cartilage & bone formation, energy production and digestion. Impaired absorption of Mn may occur with excess intake of Fe, Ca, Cu, folic acid, or phosphorous compounds, or use of long-term TPN, Mg-containing antacids or laxatives.Deficiency may result in impaired bone/connective tissue growth, glucose & lipid dysregulation, infertility, oxidative stress, inflammation or hyperammonemia.Food sources include whole grains, legumes, dried fruits, nuts, dark green leafy vegetables, liver, kidney.	1		0	
Nutritional Profile -> Amino Acids -> Non Essential Amino Acids -> Serine Serine is important in metabolism in that it participates in the biosynthesis of purines and	12		0	

pyrimidines. It is the precursor to several amino acids including glycine and cysteine, and tryptophan in bacteria. It is also the precursor to numerous other metabolites, including sphingolipids and folate, which is the principal donor of one-carbon fragments in biosynthesis. Low - can lead to disordered methionine metabolism and deficits in acetylcholine synthesis. If simultaneous high threonine or phosphoserine, then need for vitamin B6, folate, and manganese is indicated. High - when accompanied by low threonine, indicates glucogenic compensation and catabolism. Supplement threonine and BCAAs.				
Nutritional Profile -> Fatty Acids -> Monounsaturated -> Nervonic Acid (24:1n9) Nervonic acid (24:1n9) has the longest carbon chain of all monounsaturated fatty acids. It is found in highest concentrations in nerve membranes, particularly in the myelin sheath. Factors like high carbohydrate diets that inhibit fatty acid synthesis cause low levels, and conditions like insulinemia stimulate fatty acid synthesis resulting in higher levels.	12		0	
Nutritional Profile -> Vitamins and Minerals -> Vitamin B1 Thiamin B1 is a required cofactor for enzymes involved in energy production from food, and for the synthesis of ATP, GTP, DNA, RNA and NADPH. Low B1 can result from chronic alcoholism, diuretics, digoxin, oral contraceptives and HRT, or large amounts of tea & coffee (contain anti-B1 factors). B1 deficiency may lead to dry beriberi (e.g., neuropathy, muscle weakness), wet beriberi (e.g., cardiac problems, edema), encephalopathy or dementia. Food sources include lentils, whole grains, wheat germ, Brazil nuts, peas, organ meats, brewer's yeast, blackstrap molasses, spinach, milk & eggs	11		0	
Nutritional Profile -> Fatty Acids -> Saturated -> Stearic Acid (18:0) Stearic acid is one of the most common saturated fatty acids found in nature following palmitic acid. The triglyceride derived from three molecules of stearic acid is called stearin. Stearic acid (18:0) is a saturated fatty acid that is two carbon atoms longer than palmitic acid. Diets high in saturated fat contribute to elevated	6		0	

levels of stearic acid in the body. High evels in plasma occur with high serum triglycerides, which is a risk factor in atherosclerotic vascular disease.				
Nutritional Profile -> Amino Acids -> Essential Amino Acids -> Other Essential Amino Acids -> Tyrosine The word 'tyrosine' is from the Greek tyros, meaning cheese, as it was first discovered in 1846 by German chemist Justus von Liebig in the protein casein from cheese. In dopaminergic cells in the brain, tyrosine is converted to L-DOPA by the enzyme tyrosine hydroxylase (TH). TH is the rate-limiting enzyme involved in the synthesis of the neurotransmitter dopamine. Dopamine can then be converted into catecholamines, such as norepinephrine (noradrenaline) and epinephrine (adrenaline). The thyroid hormones triiodothyronine (T3) and thyroxine (T4) in the colloid of the thyroid also are derived from tyrosine. Tyrosine (or its precursor phenylalanine) is needed to synthesize the benzoquinone structure which forms part of coenzyme Q10. Low - implicated in depression, hypothyroidism, and blood pressure. If phenylalanine is normal or high (barring PKU), iron, vitamin C, and niacin supplementation might be indicated to help convert phenylalanine to tyrosine. High - inadequate utilization of tyrosine. Supplement the cofactors needed here including iron, copper, vitamin B6, and ascorbate.	5		0	
Nutritional Profile -> Fatty Acids -> Ratios -> EPA/DGLA Ratio The balance of 20-carbon or eicosanoic fatty acids is critical for proper supply of the prostanoid and leukotriene 1-, 2-, and 3-series local hormones that control a host of cellular functions and responses. The EPA/DGLA ratio will be low when DGLA is elevated relative to EPA, indicating a need for EPA sources like fish oils. When the ratio is high, sources of DGLA (black currant or evening primrose oil) are indicated.	3		0	
Nutritional Profile -> Antioxidants -> Glutathione Glutathione (GSH) is composed of cysteine, glutamine & glycine. GSH is a source of sulfate and plays a key role in antioxidant activity and detoxification of toxins. GSH requirement is increased with high-fat diets, cigarette smoke, cystinuria, chronic alcoholism, chronic acetaminophen use, infection, inflammation and toxic exposure. Deficiency may result in oxidative stress & damage, impaired detoxification,	2		0	

altered immunity, macular degeneration and increased risk of chronic illness. Food sources of GSH precursors include meats, poultry, fish, soy, corn, nuts, seeds, wheat germ, milk and cheese.				