

Urinary Metabolic Profile Quick Reference Guide

Analyte	Cofactor/Nutrient Associations		Considerations
Glycolysis Metabolites			
Pyruvate Anaerobic breakdown product of glucose.	<ul style="list-style-type: none"> Alpha Lipoic acid B-Complex (B1, B3, B5) 	<ul style="list-style-type: none"> CoQ10 Manganese Magnesium 	<ul style="list-style-type: none"> Salicylate toxicity Vigorous exercise Inefficient acquisition into CAC (Citric Acid Cycle) Tissues under limiting O₂ conditions (asthma, infection, trauma) Lactic acidosis (apnea, anemia, seizure, respiratory/cardiac insufficiency) Short bowel syndrome Ketoacidosis (alcohol intake, dieting abuse, vomiting, high fat diet, uncontrolled diabetes, prolonged fasting)
Lactate Anaerobic breakdown product of pyruvate when there is insufficient O ₂ to support pyruvate entry into CAC.	<ul style="list-style-type: none"> Alpha Lipoic acid B-Complex (B1, B3, B5) 	<ul style="list-style-type: none"> CoQ10 	<i>Refer to: Pyruvate</i> <ul style="list-style-type: none"> Acid/base imbalance
Citric Acid Cycle (CAC) Metabolites			
Aerobic intermediates of the Citric Acid Cycle. Fuel molecules - amino acids, fatty acids and carbohydrates enter this cycle through Acetyl-CoA to generate cellular energy .			
Citrate	<ul style="list-style-type: none"> Alpha Lipoic acid L-Arginine Aspartic acid 	<ul style="list-style-type: none"> B complex GSH Manganese Essential amino acids 	<ul style="list-style-type: none"> GSH deficiency High carbohydrate or citrate/citric acid intake Inefficient cycling of CAC & mitochondrial energy production Excessive fatigue/weakness Hyperparathyroidism
Cis-Aconitate	<ul style="list-style-type: none"> Alpha Lipoic acid Aspartic acid L-Cysteine B Complex 	<ul style="list-style-type: none"> GSH Manganese Arginine Iron 	<i>Refer to: Citrate</i>
Isocitrate	<ul style="list-style-type: none"> Alpha-Ketoglutarate Alpha Lipoic acid Aspartic acid Magnesium 	<ul style="list-style-type: none"> B-Complex (B3) Arginine GSH Manganese 	<i>Refer to: Citrate</i>
Alpha-Ketoglutarate	<ul style="list-style-type: none"> Alpha-Ketoglutarate Alpha Lipoic acid L-Arginine 	<ul style="list-style-type: none"> B-Complex (B1, B3, B5) L-Glutamine Essential amino acids Manganese 	<ul style="list-style-type: none"> Megaloblastic anemia Insulin resistance Diabetes mellitus Excessive fatigue/weakness Inefficient cycling of CAC & mitochondrial energy production Uremia
Succinate	<ul style="list-style-type: none"> CoQ10 B Complex (B2) Essential amino acids L-Isoleucine 	<ul style="list-style-type: none"> L- Valine Manganese Iron 	<ul style="list-style-type: none"> Tissue ischemia/poor oxygenation Inefficient cycling of CAC & mitochondrial energy production Excessive fatigue/weakness Ketosis
Fumarate	<ul style="list-style-type: none"> CoQ10 B Complex (B2, B3) 	<ul style="list-style-type: none"> L-Tyrosine L-Phenylalanine 	<ul style="list-style-type: none"> Insulin resistance Inefficient cycling of CAC & mitochondrial energy production
Malate	<ul style="list-style-type: none"> CoQ10 	<ul style="list-style-type: none"> B Complex (B3) 	<i>Refer to: Fumarate</i> <ul style="list-style-type: none"> Uremia Malate/malic acid intake

Cofactor nutrient associations do not necessarily reflect a physiological need.

This Guide is intended for use by the clinician for informational purposes only. This guide is not to be used for the prevention, diagnosis, or treatment of health conditions. The Considerations are not inclusive but represent an array of scenarios that are not intended for diagnosis of any particular patient case or condition. This information is not to be used as a substitute for professional medical care.

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Fatty Acid Oxidation Products of fatty acid oxidation (omega-oxidation).			
Suberate	<ul style="list-style-type: none"> • CoQ10 • Choline 	<ul style="list-style-type: none"> • L-Carnitine • Vitamin B2 	<ul style="list-style-type: none"> • Liver disease • Compromised Beta-oxidation • Respiratory chain insufficiency • Intake of medium chain triglycerides (coconut oil) • Salicylic acid/ Acetaminophen/Valproic acid (VPA) use • Hypoglycemia • Recurrent infections • Fructose intolerance • Fever • Fasting • Malnutrition • Serious illness • Weakness, Fatigue, Nausea • Ketosis • Lactic acidosis
Adipate	<i>Refer to: Suberate</i>		<i>Refer to: Suberate</i> <ul style="list-style-type: none"> • Food additive (Jell-O®) intake
Ethylmalonate	<ul style="list-style-type: none"> • Magnesium 	<i>Refer to: Suberate</i>	<i>Refer to: Suberate</i>
Methylsuccinate	<i>Refer to: Suberate</i>		<i>Refer to: Suberate</i>

Ketone Metabolites

Ketone bodies formed from fatty acids for cellular energy in conditions of impaired glucose oxidation.

Alpha-Hydroxybutyrate	<ul style="list-style-type: none"> • Biotin • Vitamin B12 • N-Acetylcysteine • Glutathione • Glycine • Folate 	<ul style="list-style-type: none"> • Vitamin B6 • Chromium • Vanadium • Alpha Lipoic acid 	<ul style="list-style-type: none"> • Lactic acidosis • Fructose intolerance • Respiratory chain insufficiency • Inefficient mobilization of carbohydrate stores & aerobic cycling • Oxidative stress increasing demand for glutathione • Methionine malabsorption • Vigorous exercise • Protein malnutrition • Ketosis
Beta-Hydroxybutyrate Glucose uptake.	<ul style="list-style-type: none"> • Biotin • Vitamin B12 	<ul style="list-style-type: none"> • Chromium • Vanadium 	<i>Refer to: Alpha-Hydroxybutyrate</i> <ul style="list-style-type: none"> • Pulmonary infection • Viral gastroenteritis • Hyperthyroidism • Vitamin B12 deficiency • Pregnancy

Markers for Cofactor Need

Alpha-Ketoisovalerate Branched Chain Amino Acid Catabolism (Valine) utilized in muscle tissue for energy production.	<ul style="list-style-type: none"> • Alpha Lipoic acid • B-Complex (B1, B3, B5, B6) 	<ul style="list-style-type: none"> • Magnesium 	<ul style="list-style-type: none"> • Lactic acidosis • Ketosis
Alpha-Ketoisocaproate Branched Chain Amino Acid Catabolism (Leucine) utilized in muscle tissue for energy production.	<ul style="list-style-type: none"> • Alpha Lipoic acid • B-Complex (B1, B3, B5, B6) 	<ul style="list-style-type: none"> • Magnesium 	<i>Refer to: Alpha-Ketoisovalerate</i>
Alpha-Keto-Beta-Methylvalerate Branched Chain Amino Acid Catabolism (Isoleucine) utilized in muscle tissue for energy production.	<ul style="list-style-type: none"> • Alpha Lipoic acid • B-Complex (B1, B3, B5, B6) 	<ul style="list-style-type: none"> • Magnesium 	<i>Refer to: Alpha-Ketoisovalerate</i>
Beta-Hydroxyisovalerate Branched Chain Amino Acid Catabolism (Leucine) utilized in muscle tissue for energy production.	<ul style="list-style-type: none"> • Biotin 	<ul style="list-style-type: none"> • Magnesium 	<ul style="list-style-type: none"> • Ketosis • Protein malnutrition • Long-term anticonvulsant therapy (VPA) • Biotin deficiency (alopecia, eczema/seborrheic/candida dermatitis, immune deficiencies, muscle weakness) • Antibiotic overuse destroying biotin-producing microorganisms in gut

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Analyte	Cofactor/Nutrient Associations		Considerations
Markers for Cofactor Need Continued			
Methylmalonate <ul style="list-style-type: none"> Branch Chain Amino Acid Catabolism (Valine). Common pathway of Branch Chain Amino Acids into CAC. Odd chain fatty acid catabolism. 	<ul style="list-style-type: none"> Glutathione 	<ul style="list-style-type: none"> Vitamin B12 	<ul style="list-style-type: none"> Pernicious anemia Megaloblastic anemia Bacterial gut metabolism Vitamin B12 deficiency (deficient intake, achlorhydria-induced malabsorption, ileal resection, pancreatitis) Neurological abnormalities Short bowel syndrome
Kynurenate <ul style="list-style-type: none"> Product of tryptophan catabolism thru the kynurenine pathway. In cases of dietary nicotinic acid deficiency the kynurenine pathway becomes important for nicotinic acid synthesis. 	<ul style="list-style-type: none"> Vitamin B6 	<ul style="list-style-type: none"> Vitamin B1, B3 	<ul style="list-style-type: none"> Vitamin B3 deficiency Vitamin B6 deficiency Disease states of excess estrogens " Pellagra-like " symptoms
Hydroxymethylglutarate (HMG) <ul style="list-style-type: none"> CoQ10 Synthesis Catabolism of Leucine Precursor of Cholesterol Synthesis of Ketone Bodies 	<ul style="list-style-type: none"> Vitamin B6 	<ul style="list-style-type: none"> CoQ10 	<ul style="list-style-type: none"> Anaerobic glycolysis Ketosis Gastrointestinal yeast overgrowth Cholesterol lowering drugs (HMG-CoA reductase inhibitors)
Markers of Neurotransmitter Metabolism			
Homovanillate (HVA) <ul style="list-style-type: none"> Catecholamine Catabolism (Dopamine). 	<ul style="list-style-type: none"> Ascorbic acid Iron Magnesium Essential amino acid 	<ul style="list-style-type: none"> Folic acid Copper L-Tyrosine B Complex (B2,B3,B6, B12) 	<ul style="list-style-type: none"> Ganglioblastoma Neuroblastoma Pheochromocytoma L-Dopa medication Fatigue Anxiety, Depression, Insomnia Heavy metals (Cd,Pb,Hg,As) Excess cholinergic stimulation from chronic stress
Vanilmandelate (VMA) <ul style="list-style-type: none"> Catecholamine Catabolism (Epinephrine, Norepinephrine). 	<i>Refer to: Homovanillate</i>		<p style="text-align: center;"><i>Refer to: Homovanillate</i></p> <ul style="list-style-type: none"> Carcinoid tumor Elevated levels must be considered in association with HVA for possible abnormal tissue growth Catecholamine-containing foods (banana).
5-Hydroxyindoleacetate (5-HIAA) <ul style="list-style-type: none"> Serotonin Catabolism. Serotonin is found in eneterochromaffin cells, brain & platelets. In the first two, it is produced from tryptophan. In platelets , it is taken up from plasma. 	<ul style="list-style-type: none"> 5-Hydroxytryptophan Essential amino acids 	<ul style="list-style-type: none"> Vitamin B6 Folate 	<ul style="list-style-type: none"> Celiac disease IBS (diarrhea-type) Whipple's disease Oat cell carcinoma of the bronchus Mood disorders, Anxiety, Depression, Insomnia (Low) Constipation (Low) Fatigue SSRI drugs Alcohol intake Carcinoid syndrome Tryptophan rich foods (avocado, banana, plum, pineapple, walnut, turkey, tomato).
Quinolinatate (QA) <ul style="list-style-type: none"> Tryptophan catabolism. Metabolite of tryptophan in the kynurenine pathway. This part of the pathway is chiefly activated by IFN-gamma and IFN-alpha. Quinolinatate is markedly elevated in the CNS following trauma or inflammation. Phthalate plasticizers have been implicated to increase QA. 	<ul style="list-style-type: none"> Antioxidants (Vitamin C, E, Lipoic acid) 		<ul style="list-style-type: none"> Autoimmune condition Chronic fatigue Phthalate exposure Neuronal tissue degeneration - plays a role in neuronal injury through activation of N-methyl-D-aspartate (NMDA) receptor. Inflammatory bowel condition Oxidative stress Chronic inflammation from bacterial/viral/fungal/ parasitic infections

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Markers of Detoxification		
Para-Hydroxyphenyllactate <ul style="list-style-type: none"> Pro-oxidant. Carcinogenic metabolite of Tyrosine. Promotes lipid peroxidation in liver. 	<ul style="list-style-type: none"> Antioxidants (Vit amin C, E, Lipoic acid) 	<ul style="list-style-type: none"> Tumor tissue Liver disease Scurvy Lactic acidosis Inefficient catabolism of tyrosine
Orotate <ul style="list-style-type: none"> Urea cycle. Sensitive marker of ammonia build-up. Pyrimidine synthesis. 	<ul style="list-style-type: none"> Alpha-Ketoglutarate Arginine L-Citrulline Aspartic acid Vitamin B3, B6 Magnesium Folate 	<ul style="list-style-type: none"> Folate malabsorption High cell turnover (tissue breakdown, menses, chemotherapy) Alcohol intake Insufficient detoxification of ammonia load through urea cycle. Excess glutamine intake
Pyroglutamate <ul style="list-style-type: none"> By- product of glutathione-dependent amino acid recovery from kidneys due to inefficient recycling of GSH. 	<ul style="list-style-type: none"> N-acetylcysteine Glutathione Alpha Lipoic acid Glycine Taurine 	<ul style="list-style-type: none"> Glycine deficiency Glutathione depletion Acetaminophen use Vegetarian or low-protein diet, under-nutrition. Renal insufficiency Toluene exposure Pregnancy (increased metabolic demand for glycine) Glutamine degradation (hyperammonemia, urea cycle defects)
Benzoate <ul style="list-style-type: none"> Combines with glycine to form hippurate in the liver. Liver Phase II conjugation. 	<ul style="list-style-type: none"> Glycine 	<ul style="list-style-type: none"> Bacterial metabolism of phenylalanine (gut, urinary tract) from hippurate Toluene exposure Food additive (sodium benzoate, benzoic acid), cranberries, plums, prunes, rhubarb, preserved foods, pickles.
Hippurate <ul style="list-style-type: none"> Product of benzoate combining with glycine in the liver. Liver phase II conjugation. 	<ul style="list-style-type: none"> Glycine 	<p>Uremia</p> <p><i>Refer to:</i> Benzoate</p>

Markers of Bacterial Metabolism

Para-Hydroxybenzoate	<ul style="list-style-type: none"> Digestive aids Glycine, Vitamin B5 (Hepatic Phase I & II support) Glutamine & other free from amino acids to normalize gut permeability Pre and Probiotics Eliminate food allergies Fiber Phytonutrients Essential Fatty Acids Restore Acid/Alkaline Balance 	<ul style="list-style-type: none"> Liver disease Digestive failure Compromised energy production and cellular metabolic pathways Gastrointestinal pathology (celiac's, enteritis, small bowel disease, intestinal resection, Intestinal obstruction, lactose intolerance) Paraben exposure (cosmetics & body care products)
Para-Hydroxyphenylacetate	<p><i>Refer to:</i> para-Hydroxybenzoate</p>	<p><i>Refer to:</i> para-Hydroxybenzoate</p> <ul style="list-style-type: none"> Giardiasis Tyrosine degradation from <i>Proteus vulgaris/ Clostridium difficile</i> in gut
2-Hydroxyphenylacetate <ul style="list-style-type: none"> Metabolite of phenylalanine. 	<p><i>Refer to:</i> para-Hydroxybenzoate</p>	<p><i>Refer to:</i> para-Hydroxybenzoate</p> <ul style="list-style-type: none"> Uremia BH4 deficiency
3-Indoleacetate	<p><i>Refer to:</i> para-Hydroxybenzoate</p>	<p><i>Refer to:</i> para-Hydroxybenzoate</p>
Tricarallylate <ul style="list-style-type: none"> Inhibits Citrate uptake. Chelates divalent cations like Mg. 	<p><i>Refer to:</i> para-Hydroxybenzoate</p> <ul style="list-style-type: none"> Magnesium Calcium Zinc 	<p><i>Refer to:</i> para-Hydroxybenzoate</p> <ul style="list-style-type: none"> Bacterial conversion of CAC intermediate, aconitate into tricarallylate

Note: Dysbiosis may be influenced by excess use of antacids; prescription medications; NSAIDS; broad-spectrum antibiotics with consequent abnormal growth of unfavorable microflora; food allergies; and the consumption of contaminated foods.

This test does not assess for neonatal inborn errors of metabolism

Nutrient Food Source Guide

In addition to a customized supplement regimen prescribed by your clinician, he or she may suggest a variety of foods that may enhance the intake of key nutrients from natural sources.

Listed below are foods rich in the corresponding nutrient (*unless specified in italics*).

A balanced intake of vitamins, minerals, and other nutrients from dietary proteins, fats and carbohydrates from whole plant and animal sources is part of healthy lifestyle, and may help prevent deficiencies.

Minerals	
Calcium	Swiss, Jack, cheddar and other cheeses, yogurt, broccoli, sardines, canned salmon (w/bones), goat milk, cow 's milk, collard greens, turnip greens, kale, broccoli, almonds, brazil nuts, soybeans, tofu, blackstrap molasses, corn tortillas, dried figs
Magnesium	Dark green vegetables, almonds, pecans, cashews, brazil nuts, seeds, legumes, soy products, wheat bran and germ, millet, brown rice, avocado, dried apricots
Potassium	Spinach, parsley, broccoli, lima beans, peas, tomatoes, potato skins, oranges, bananas, apples, avocados, raisins, dried apricots, whole grains, wheat germ, flounder, salmon, sardines, cod
Phosphorus	Meats, fish, chicken, turkey, milk, cheese, eggs, seeds, nuts, whole grains, brewer ' s yeast, wheat germ, wheat bran
Silicon	Rice bran, oat bran, wheat bran, alfalfa, cucumber, avocado, strawberries, onions, dark greens, horsetail and stinging nettle herbs
Sodium	Seafood, beef, poultry, celery, beets, carrots, artichokes, kelp and other sea vegetables. Processed foods contain a significant amount and may be advised to be avoided on salt-restrictive diets
Sulfur	Meats, fish, poultry, egg yolks, legumes, onions, garlic, cabbage, Brussels sprouts, turnips, kale, kelp

Antioxidants	
CoQ10 (Ubiquinone)	<i>Ubiquitous in living systems, synthesized by the body</i> , oily fish, organ meats, whole grains
Glutathione	<i>Ubiquitous in living systems, obtained from L-cysteine, glutamic acid and glycine, found in all cells of plants and animals</i>
Alpha-Lipoic Acid	<i>Ubiquitous in living systems</i> , liver, brewer ' s yeast
N-Acetylcysteine (NAC)	Cysteine is found in most high protein foods, <i>NAC is not found in the diet</i>

Trace Elements	
Iron	Beef, liver, kidney, pork, lamb, chicken, clams, oysters, egg yolks, salmon, whole wheat, millet, oats, brown rice, lima beans, soybeans, kidney beans, green peas, almonds, brazil nuts, walnuts, pine nuts, pumpkin seeds, sesame seeds, sunflower
Zinc	Oysters, herring, beef, lamb, pork, liver, egg yolks, milk products, whole wheat, rye, oats, pecans, Brazil nuts, pumpkin seeds, ginger root, mustard, chili powder, peas, carrots, beets, cabbage
Selenium	Brewer ' s yeast, wheat germ, barley, oats, brown rice, whole wheat, brazil nuts, liver, butter, scallops, lobster, shrimp, clams, crab, oysters, lamb, garlic, onions, mushrooms, broccoli, Swiss chard, radishes
Copper	Buckwheat, whole wheat, shrimp, liver, brazil nuts, almonds, hazelnuts, walnuts, pecans, soybeans, dark leafy greens, prunes, cocoa
Manganese	Pecans, almonds, whole grains, egg yolks, seeds, peas, beans, spinach, tea
Iodine	Kelp, cod, sea bass, haddock, perch, shellfish, iodized salt
Molybdenum	Liver, oats, buckwheat, wheat germ, lentils, lima beans, green beans, soybeans, potatoes, spinach, cauliflower,
Boron	Leafy greens, apples, pears, grapes, legumes
Chromium	Brewer ' s yeast, beef, liver, whole wheat, wheat germ, rye, fresh chilies, oysters, potatoes, green peppers, eggs, chicken, apples, butter, bananas, spinach
Vanadium	Soy, sunflower, safflower, corn and olive oil, buckwheat, parsley, oats, rice, green beans, carrots, cabbage, dill, radish, mushrooms, oysters, herring

Vitamins & Other Like Compounds

Vitamin A	Liver and fish liver oil, egg yolks, whole milk, cream, butter
Mixed Carotenoids	Seaweed, mustard greens, Brussels sprouts, spinach, broccoli, kale, asparagus, parsley, carrots, sweet potatoes, squash, red cabbage, tomatoes, apricots, peaches, cherries, berries
Vitamin D3	Fish liver oil, mackerel, salmon, sardines, herring, egg yolks, butter, homogenized milk
Vitamin E	Cold-pressed vegetable, seed and nut oils, wheat germ oil, whole grains, soybeans, uncooked green peas, spinach, asparagus, kale, cucumber
Vitamin C	Citrus fruits, strawberries, mango, papaya, watermelon, tomatoes, broccoli, Brussels sprouts, cauliflower, cabbage, spinach
Vitamin B1 (Thiamin)	Whole or enriched grain products, brown rice, brewer 's yeast, blackstrap molasses, spinach, cauliflower, most nuts, sunflower seeds, peanuts, peas, beans, avocado, pork
Vitamin B2 (Riboflavin)	Whole or enriched grain products, brewer 's yeast, organ meats, mackerel, trout, eel, herring, shad, nori, eggs, shellfish, millet, wild rice, dried peas, beans, sunflower seeds, asparagus, collards, broccoli, spinach, mushrooms, avocado
Vitamin B3 (Niacin)	Synthesized from the amino acid tryptophan, Liver and other organ meats, poultry, fish, peanuts, brewer 's yeast, dried beans and peas, wheat germ, whole grains, avocado, dates, figs, prunes (milk and eggs due to significant levels of tryptophan)
Vitamin B5 (Pantothenic Acid)	Organ meats, chicken, beef, brewer 's yeast, egg yolks, fish, chicken, whole grains, cheese, peanuts, dried beans, sweet potato, green peas, broccoli, avocado, cauliflower
Vitamin B6 (Pyridoxine)	Liver and other organ meats, fish, poultry, egg yolk, whole wheat, wheat germ, soybeans and other dried beans, peanuts, walnuts, banana, prunes, potatoes, cauliflower, cabbage, avocado
Vitamin B12	Whole grains, organ meats, trout, herring, mackerel, crab, oysters, egg yolk, yogurt, tempeh
Vitamin K	Synthesized by intestinal bacteria, dark leafy greens, blackstrap molasses, liver, milk, yogurt, egg yolks, fish liver oils
Folic acid	Spinach, kale, beet greens, beets, chard, asparagus, broccoli, liver, brewer 's yeast, whole grains
Biotin	Egg yolks, liver, brewer 's yeast, nuts, milk, unpolished rice
Choline	Synthesized from the amino acid glycine, lecithin from soybeans, peanuts, egg yolk, milk brewer 's yeast, wheat germ, fish, leafy greens, organ meats
Inositol	Synthesized from glucose, liver, lecithin, whole grains, wheat germ, lima beans, peanuts, brewer 's yeast, cabbage, citrus fruits (except lemons), cantaloupe, raisins, unrefined molasses
PABA	A component of folic acid, synthesized by intestinal bacteria, whole grains, wheat germ, brewer 's yeast, liver, eggs, molasses
L-Carnitine	Synthesized by the liver and kidneys, red meats, fish, poultry, milk products

Other Considerations

Malic Acid	Apples, cherries, berries, pears, plums, peaches, tomatoes, rhubarb
Probiotics	Foods containing live bacteria for health promoting properties. Kefir, yogurt, fermented vegetables
Prebiotics	Fructooligosaccharides (FOC) and other digestion resistant carbohydrates that are beneficial to the growth and activity of healthy native bacteria found in the colon. Jerusalem artichoke tubers, onions, leeks, wheat, honey, garlic, bananas, asparagus, artichokes
Essential Fatty Acids	Essential fats, polyunsaturates that cannot be synthesized by the body and must be obtained from the diet. Flaxseed oil, hempseed oil, walnuts, pumpkin seeds, Brazil nuts, sesame seeds, avocados, dark leafy green vegetables (kale, spinach,

Amino Acids	
	Amino acids can be defined as either 'nonessential' or 'essential'. Our bodies are able to manufacture the nonessential amino acids. Essential amino acids must be supplied by the diet
Alpha-Ketoglutarate	Ubiquitous in living systems, present in whole plant and animal foods
L-Arginine	Lean meats, fish, nuts, milk, cheese, eggs, nuts, whole grains, chocolate
Aspartic acid	<i>Utilized to form mineral salts which are consequently easily absorbed</i>
L-Citrulline	<i>Synthesized in the body from ornithine, converted to arginine</i>
L-Cysteine	Found as cystine in poultry, yogurt, oats, wheat germ, egg yolks, garlic, onions, broccoli, Brussels sprouts, red peppers
L-Glutamine	<i>Synthesized from the amino acids arginine, ornithine, and proline, abundant in both animal and vegetable protein,</i>
L-Glycine	<i>Synthesized from choline in the liver and from the amino acids threonine and serine</i>
5-Hydroxytryptophan	Tryptophan- cottage cheese, fish, lean meats, poultry, peanuts roasted w/ skin, sesame seeds, dried lentils.
(Tryptophan is an essential amino acid)	Essential amino acids cannot be synthesized by the body and must be obtained from the diet. Animal sources contain these essential amino acids as complete proteins and include; beef, pork, poultry, lamb, turkey, fish, milk, eggs, and cheese. Vegetarian sources of proteins must be combined to ensure adequate levels of essential amino acids and include; whole grains, wheat germ, legumes, nuts and seeds
Contraindicated with concomitant use of MAO inhibitors	
L-Isoleucine (essential amino acid)	Essential amino acids cannot be synthesized by the body and must be obtained from the diet. Animal sources contain these essential amino acids as complete proteins and include; beef, pork, poultry, lamb, turkey, fish, milk, eggs, and cheese. Vegetarian sources of proteins must be combined to ensure adequate levels of essential amino acids and include; whole grains, wheat germ, legumes, nuts and seeds
L-Phenylalanine (essential amino acid)	Essential amino acids cannot be synthesized by the body and must be obtained from the diet. Animal sources contain these essential amino acids as complete proteins and include; beef, pork, poultry, lamb, turkey, fish, milk, eggs, and cheese. Vegetarian sources of proteins must be combined to ensure adequate levels of essential amino acids and include; whole grains, wheat germ, legumes, nuts and seeds
Contraindicated with concomitant use of MAO inhibitors or Tricyclic antidepressants	
L-Taurine	<i>Synthesized from cysteine using B6, lean meats, fish</i>
L-Tyrosine Contraindicated with concomitant use of MAO inhibitors or Tricyclic antidepressants	<i>Synthesized from the amino acid phenylalanine, soy products, chicken, fish, almonds, avocado, bananas, dairy products, lima beans, pumpkin seeds, sesame seeds</i>
L-Valine (essential amino acid)	Essential amino acids cannot be synthesized by the body and must be obtained from the diet. Animal sources contain these essential amino acids as complete proteins and include; beef, pork, poultry, lamb, turkey, fish, milk, eggs, and cheese. Vegetarian sources of proteins must be combined to ensure adequate levels of essential amino acids and include; whole grains, wheat germ, legumes, nuts and seeds
L-Leucine (essential amino acid)	Essential amino acids cannot be synthesized by the body and must be obtained from the diet. Animal sources contain these essential amino acids as complete proteins and include: beef, pork, poultry, lamb, turkey, fish, milk, eggs, and cheese. Vegetarian sources of proteins must be combined to ensure adequate levels of essential amino acids and include; whole grains, wheat germ, legumes, nuts and seeds

The amino acids mentioned above do not represent a complete listing of all amino acids required by the body. Including in the diet complete protein sources of good quality may provide satisfactory provisions of the amino acid pool. Protein needs depend on several factors including: age, weight, health, body composition and physical activity level.