

Interpretive Guide for Bloodspot Amino Acids

Intervention Options

Amino Acids	LOW	HIGH
	<i>Balanced or custom mixtures of all essential amino acids are recommended for repletion of low levels. Other specific options are shown below.</i>	
Arginine (Arg)	Arg, 500 mg BID	Mn, 15 mg
Histidine (His)	Folate 800 mcg; His, 500 mg TID	
Isoleucine (Ile)		B6, 100 mg; Check for insulin insensitivity
Leucine (Leu)		B6, 100 mg; Check for insulin insensitivity
Lysine (Lys)	Carnitine, 1-2 g	Vitamin C, 1 g BID; Niacin, 50 mg; B6, 100 mg; Iron, 15 mg; α -KG, 300 mg TID
Methionine (Met)		B6, 100 mg; α -KG, 600 mg BID; Mg, 200 mg BID; SAM, 200 mg BID
Phenylalanine (Phe)		Iron, 30 mg; Vitamin C, 1 gm TID; Niacin, 50 mg; Low Phe diet
Taurine (Tau)	Tau, 300 mg BID; B6, 100 mg	Vit. E, 800 IU; Vit. C, 1 gm TID; -Carotene, 25,000 IU; CoQ10, 30 mg; Lipoate
Threonine (Thr)		B6, 100 mg, Zn, 30 mg
Tryptophan (Trp)	5HTP, 50 mg TID	Niacin, 50 mg; B6, 100 mg BID
Valine (Val)		B6, 100 mg; Check for insulin insensitivity

Arginine

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 manganese may help.

Histidine

Low - check dietary protein, or malabsorption if other essential AAs are low. Low histidine is associated with rheumatoid arthritis and folate deficiency.

High - may indicate excessive protein intake.

Isoleucine

Low - a chronic deficiency of this AA can cause hypoglycemia and related problems and loss of muscle mass or inability to build muscle.

High - non-fasting specimen, large intake of this AA or incomplete metabolism of it. If other BCAAs are high, add vitamin B6 to aid metabolism.

Leucine

Low - potential catabolism of skeletal muscle.

High - see isoleucine

Lysine

Low - either poor dietary intake or too high intake of arginine. Low levels can inhibit transamination of collagen synthesis. If concurrent weakness

or high triglycerides, add carnitine.

High - impaired metabolism of lysine. Add vitamin C, niacin, α -KG, vitamin B6, and iron to enhance utilization of lysine.

Methionine

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.

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Phenylalanine

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.

Taurine

Low - may increase risk for oxidative stress, fat maldigestion, high cholesterol, atherosclerosis, angina, arrhythmias, 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.

Threonine

Low - associated with the increased catabolic state of diabetes or hyperinsulinemia. Supplement threonine and BCAAs.

High - excessive dietary intake or possible insufficient metabolism of threonine.

The initial step here requires (vitamin B6) and zinc is needed to phosphorylate vitamin B6 to its active coenzyme form, so supplementation with vitamin B6 and zinc can be helpful.

Tryptophan

Low - commonly correlated with depression, insomnia, and

schizophrenia. Supplementation with L-tryptophan or 5-hydroxy-tryptophan (5-HTP) may help. 5-HTP is only one enzymatic step away from serotonin.

High - possibly inadequate metabolism of tryptophan. Required nutrients for this process include niacin and vitamin B6.

Valine

Low - deficiency in this or other BCAAs indicates potential muscle loss. If several essential amino acids (AAs) are low, check for adequate stomach acid.

Supplement the BCAAs.

High - vitamin B6 functional deficit. If other BCAAs are high, vitamin B6 should be given.

References:

Rudman, D., et al., Fasting plasma amino acids in elderly men. *Am J Clin Nutr*, 49(3). 559-66, 1989.

Irwin, M.I. and D.M. Hegsted, A conspectus of research on amino acid requirements of man. *J Nutr*, 101(4). 539-66, 1971.

Irwin, M.I. and D.M. Hegsted, A conspectus of research on protein requirements of man. *J Nutr*, 101(3). 387-429, 1971.

Bruinvels, J. and L. Pepplinkhuizen, Impaired glycine-serine conversion and increased plasma taurine levels in episodic psychotic patients with psychedelic symptoms. *J Psychiatr Res*, 18(3). 307-18, 1984.

Scriver, C. and L. Rosenberg, Amino Acid Metabolism and It's Disorders. Major problems in clinical pediatrics, ed. A. Schaffer. Vol. X. 1973, Philadelphia: W. B. Saunders. 491.

Nyhan, W., Abnormalities in amino acid metabolism in clinical medicine. 1984, Norwalk: Appleton-Century-Crofts. 463.

Friedman, M., Absorption and utilization of amino acids. Vol. 1. 1989, Boca Raton: CRC. 257.

Cynober, L.E., Amino acid metabolism and therapy in health and nutritional disease. 1995, Boca Raton: CRC Press. 459.

Askanazi, J., et al., Muscle and plasma amino acids after injury: the role of inactivity. *Ann Surg*, 188(6). 797-803, 1978.

Bralley, J. and R. Lord, Treatment of chronic fatigue syndrome with specific amino acid supplementation. *J App Nutr*, 46(3). 74-9, 1994.

Kirvela, O., et al., Respiratory and sleep patterns during nocturnal in fusions of branched chain amino acids. *Acta Anaesthesiol Scand*, 34(8). 645-8, 1990.

Nair, K.S., R.G. Schwartz, and S. Welle, Leucine as a regulator of whole body and skeletal muscle protein metabolism in humans. *Am J Physiol*, 263(5 Pt 1). E928-34, 1992.

Manjarrez, G., et al., Free tryptophan as an indicator of brain serotonin synthesis in infants. *Pediatr Neurol*, 18(1). 57-62, 1998.

Neumeister, A., et al., Effects of tryptophan depletion in drug-free depressed patients who responded to total sleep deprivation. *Arch Gen Psychiatry*, 55(2). 167-72, 1998.

Bellodi, L., et al., Plasma tryptophan levels and tryptophan/neutral amino acid ratios in obsessive-compulsive patients with and without depression. *Psychiatry Res*, 69(1). 9-15, 1997.

Gelenberg, A.J., et al., Tyrosine for the treatment of depression. *American Journal Psychiatry*, 137:5(May). 622-623, 1980.

Molina, J.A., et al., Cerebrospinal fluid levels of non-neurotransmitter amino acids in patients with Alzheimer's disease. *J Neural Transm*, 105(2-3). 279-86, 1998.

Milakofsky, L., N. Harris, and W.H. Vogel, Effect of repeated stress on plasma catecholamines and taurine in young and old rats. *Neurobiol Aging*, 14(4). 359-66, 1993.

Azuma, J., et al., Taurine for treatment of congestive heart failure. *Int J Cardiol*, 2(2). 303-4, 1982.

Lepage, N., et al., Age-specific distribution of plasma amino acid concentrations in a healthy pediatric population. *Clin Chem*, 43(12). 2397-402, 1997.

Hetenyi, G., Jr., P. J. Anderson, et al. (1984). "Gluconeogenesis from threonine in normal and diabetic rats." *Biochem J* 224(2): 355-60.