

**ALPHA LIPOIC ACID** – This nutrient protects against the neuronal injury that occurs in the presence of toxic proteins found in brain tissue of Alzheimer’s patients. Research clearly indicates that lipoic acid is a potent neuroprotective antioxidant which strengthens memory and stimulates nerve growth.

**B VITAMINS** – Folate, Vitamin B6 and B12 are important in methylation processes. Deficiencies in one of these vitamins can raise homocysteine levels which is linked to increased Alzheimer’s risk. Vitamin B1 protects against mitochondrial dysfunction that causes dementia. B12 improves frontal lobe functions such as language, especially in the elderly.

**CARNITINE** – The amino acid carnitine has potent antioxidant properties. Its role in the transport of fatty acids to the mitochondria explains its beneficial effects on fatigue, which include both physical and mental fatigue. Several trials have demonstrated a consistent improvement in memory, focus and cognition with carnitine supplementation.

**CHOLINE** – Another member of the B-complex, choline is the precursor molecule for the neurotransmitter acetylcholine, which is intimately involved in memory. Choline deficiency can induce mitochondrial dysfunction in the brain that clinically presents as cognitive impairment.

**CHROMIUM** – In a placebo-controlled, double-blind trial, chromium supplementation for twelve weeks enhanced cerebral function in older adults, possibly as a downstream effect of improved glucose disposal in patients with insulin resistance.

**COPPER** – Intracellular copper deficiency increases the formation of amyloid deposits in the brain. Specifically, copper accumulates in amyloid plaques while remaining deficient in neighboring brain cells indicating that copper deficiency is a plausible cause of Alzheimer’s.

**GLUTATHIONE** – This antioxidant is used up faster in brain tissue in the presence of choline deficiency.

**GLUTAMINE and ASPARAGINE** – Both act as neurotransmitters in the brain.

**INOSITOL** – A member of the B-complex of vitamins, inositol regulates cell membrane transport, thus explaining its key interaction with several hormone and regulatory functions. Research suggests it can protect against the formation of abnormally folded toxic proteins seen in Alzheimer’s patients. Inositol treatment also has beneficial effects on depression and anxiety.

**OLEIC ACID** – This fatty acid found primarily in olive oil and is the precursor to oleamide, which interacts with several neurotransmitters and has demonstrated anti-depressant like properties. Oleic acid also facilitates absorption of vitamin A into cells.

**SERINE** – This amino acid is the major component of phosphatidylserine, an integral part of cell membranes in the brain. Phosphatidylserine increases the release of several neurotransmitters, including dopamine, serotonin, acetylcholine and epinephrine, thus improving the rate at which mental processes occur, without the hyperactivity or compulsive behavior that often occurs with drugs that stimulate a single neurotransmitter.

**VITAMIN A** – In the Physician’s Health Study II, vitamin A supplementation (50mg) improved cognition and verbal memory in men. Short term (1 year) effects of cognitive function were not seen, but significant benefit occurred in those on long-term treatment (18 years.)

**VITAMIN C** – Next to adrenal glands, nerve endings contain the highest levels of vitamin C in the body. High intakes of vitamin C are associated with lower risk of Alzheimer’s disease.

**VITAMIN E** – In addition to antioxidative properties, vitamin E reduces death to cells in the hippocampus and protects brain from glutamate toxicity. High dietary intake of vitamin E may lower Alzheimer’s risk.

**ZINC** – Low functional status of zinc is linked to negative alterations of the immune-inflammatory system, which can cause depression, impair learning and memory and a reduce neurogenesis. Zinc also regulates synaptic plasticity.

*Additional nutrients tested by SpectraCell’s Micronutrient Test –*

**BIOTIN, CALCIUM, COENZYME Q10, CYSTEINE, MAGNESIUM, SELENIUM, VITAMINS B2, B3, B5, D, K and SPECTROX™** (a measure of total antioxidant function)

## REFERENCES

- Manda K, et al. Radiation-induced cognitive dysfunction and cerebellar oxidative stress in mice: protective effect of alpha-lipoic acid. *Behav Brain Res* 2007;177:7-14.
- Cho JY, et al. The combination of exercise training and alpha-lipoic acid treatment has therapeutic effects on the pathogenic phenotypes of Alzheimer's disease in NSE/APPsw-transgenic mice. *Int J Mol Med* 2010;25:337-346.
- Kim, et al. Changes in folate, vitamin B12 and homocysteine associated with incident dementia. *J Neurol Neurosurg Psychiatry* 2008;79:864-868.
- D'Anci KE, Rosenberg IH. Folate and brain function in the elderly. *Curr Opin Clin Nutr Metab Care* 2004;7:659-664.
- Smith AD, et al. Homocysteine-lowering by B vitamins slows the rate of accelerated brain atrophy in mild cognitive impairment: a randomized controlled trial. *PLoS One* 2010;5:e12244.
- Clarke et al. Low vitamin B-12 status and risk of cognitive decline in older adults. *Am J Clin Nutr* 2007;86:1384-1391.
- Bourre JM. Effects of nutrients (in food) on the structure and function of the nervous system: update on dietary requirements for brain. Part 1: micronutrients. *J Nutr Health Aging* 2006;10:377-385.
- Malaguarnera et al. Acetyl L-carnitine (ALC) treatment in elderly patients with fatigue. *Arch Gerontol Geriatr* 2008;46:181-190.
- Malaguarnera, et al. L-Carnitine treatment reduces severity of physical and mental fatigue and increases cognitive functions in centenarians: a randomized and controlled clinical trial. *Am J Clin Nutr* 2007;86:1738-1744.
- Troen AM, et al. Cognitive impairment in folate-deficient rats corresponds to depleted brain phosphatidylcholine and is prevented by dietary methionine without lowering plasma homocysteine. *J Nutr* 2008;138:2502-2509.
- Krikorian R, et al. Improved cognitive-cerebral function in older adults with chromium supplementation. *Nutr Neurosci* 2010;13:116-122.
- Cater et al. Intracellular Copper Deficiency Increases Amyloid-beta Secretion by Diverse Mechanisms. *Biochem J* 2008;412:141-152.
- Pacelli C, et al. Dietary choline deprivation impairs rat brain mitochondrial function and behavioral phenotype. *J Nutr* 2010;140:1072-1029.
- Moreno-Fuenmayor, et al. Plasma excitatory amino acids in autism. *Invest Clin* 1996;37:113-128.
- Choi JK, et al. Detection of increased scyllo-inositol in brain with magnetic resonance spectroscopy after dietary supplementation in Alzheimer's disease mouse models. *Neuropharmacology* 2010;59:353-357.
- Dasilva KA, et al. Amyloid-beta fibrillogenesis: structural insight and therapeutic intervention. *Exp Neurol* 2010;223:311-321.
- Coupland NJ, et al. Decreased prefrontal Myo-inositol in major depressive disorder. *Biol Psychiatry* 2005;57:1526-1534.
- Martin V, et al. Lipid alterations in lipid rafts from Alzheimer's disease human brain cortex. *J Alzheimers Dis* 2010;19:489-502.
- Akanmu MA, et al. Neuropharmacological effects of oleamide in male and female mice. *Behav Brain Res* 2007;182:88-94.
- Raju M, et al. Micellar oleic and eicosapentaenoic acid but not linoleic acid influences the beta-carotene uptake and its cleavage into retinol in rats. *Mol Cell Biochem* 2006;288:7-15.
- Kidd PM. A review of nutrients and botanicals in the integrative management of cognitive dysfunction. *Alt Med Rev* 1999;4:144-161.
- Grodstein, et al. A randomized trial of beta carotene supplementation and cognitive function in men: the Physicians' Health Study II. *Arch Int Med* 2007; 167:2184-2190.
- Engelhart MJ, et al. Dietary intake of antioxidants and risk of Alzheimer disease. *JAMA* 2002;287:3223-3229.
- Tupe, et al. Zinc supplementation improved cognitive performance and taste acuity in Indian adolescent girls. *J Am Coll Nutr* 2009;28:388-396.
- Szewyzck, et al. The role of zinc in neurodegenerative inflammatory pathways in depression. *Prog Neuropsychopharmacol Biol Psychiatry* 2011;35:693-701.
- Prasad AS. Impact of the discovery of human zinc deficiency on health. *J Am Coll Nutr* 2009;28:257-265.
- Atamna H. Heme, iron, and the mitochondrial decay of ageing. *Ageing Res Rev* 2004;3:303-318.
- Wilkins CH, et al. Vitamin D deficiency is associated with low mood and worse cognitive performance in older adults. *Am J Geriatr Psychiatry* 2006;14:1032-1040.