**FATIGUE**

**Carnitine** Transports fatty acids into mitochondria; Decreases both mental and physical fatigue in clinical trials.

**Chromium** Promotes glucose uptake into cells, helping stabilize blood sugar.  

**Vitamin B3** Dilates blood vessels; increases serotonin.

**Vitamin D & Calcium** Small trials show benefit with combined supplementation.

**Vitamin B2** Effective for migraine prevention, aids mitochondrial energy metabolism.

**Magnesium** Efficacious for migraine prevention in several trials; magnesium deficiency can cause arterial spasm and its role in neurotransmission may explain the migraine-magnesium depletion link.

**Carnitine** Implicated in migraine pathophysiology due to its role in mitochondrial energy metabolism.

**Lipoic Acid** Enhances mitochondrial energy metabolism.

**Vitamin C** Newly discovered role in neural tissue may explain its clinical benefit in a double blind trial on headache frequency.

**Vitamin B12** Scavenges nitric oxide, which is implicated in migraine pathogenesis.

**Folate** MTHFR gene linked to migraines. This gene raises folate requirements.

**Serine** Counteracts the overproduction of fatigue-causing stress hormones.

**CoQ10** Deficiency causes fatigue due to its role in mitochondrial energy metabolism; therapeutic benefits particularly noticeable in chronic fatigue syndrome.

**Vitamin A** When cellular levels of vitamin A are low, mitochondrial respiration and ATP production decreases.

**Vitamin E** Inverse correlation exists between fatigue and vitamin E levels.

**Vitamin D** Low levels are seen in patients with chronic fatigue syndrome; Deficiency causes reduced muscle strength.

**B Vitamins** Necessary for converting food into energy; Cofactors in the mitochondrial respiratory chain include B1, B2, B3, B5, B6, B12 and Folate.

**Antioxidants** Several studies confirm that oxidative stress exacerbates clinical symptoms of fatigue. Mitochondrial dysfunction (inefficient energy metabolism) can be treated therapeutically with antioxidants such as Selenium, Cysteine, α-Lipoic acid and Glutathione, of which unusually low levels are seen in chronic fatigue patients.

**Magnesium** Required to store energy molecule ATP; Repletion of magnesium in chronic fatigue patients shows clinical improvement in energy levels.

**Glutamine** Mental and physical fatigue coincides with reduced levels of this amino acid in various tissues. Supplementation makes muscle more sensitive to insulin, increasing energy levels.

**Fructose Intolerance** Fatigue (and hypoglycemia) are classic symptoms of this condition, since it depletes the main form of cellular energy, ATP.

**Asparagine** Supplementation of this amino acid delayed fatigue during exercise by decreasing the rate at which glycogen was used up; needed for gluconeogenesis, a process that allows glucose to be made from protein to prevent blood sugar from getting too low.

**Biotin** Helps liver utilize glycogen for energy. Animal studies confirm that biotin deficiency causes clinical fatigue.

**B Vitamins** Necessary for converting food into energy; Cofactors in the mitochondrial respiratory chain include B1, B2, B3, B5, B6, B12 and Folate.
REFERENCES


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For more references, go to http://www.spectracell.com/online-library-mnt-fatigue-abstracts/