Acetyl-l-carnitine

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Acetyl-l-carnitine (ALC) posses unique neuroprotective, neuromodulatory and neurotrophic properties, which may play an important role in counteracting various disease processes.[1] Acetyl-l-carnitine has been shown to increase NGF (nerve growth factor), to enhance repair and growth of damaged neurons in the brain. ALC may also delay mitochondrial decay that is related to ageing, and due to oxidation of lipids, proteins, RNA and DNA.[2] Human studies show that acetyl-l-carnitine can stabilise cell membrane fluidity via the regulation of sphingomyelin levels.

Acetylcholine, Acetyl-l-carnitine and Alzheimer's disease

It is known that there are a few neurotransmitters that play a role in memory, learning and cognitive function. Acetylcholine specifically activates the prefrontal cortex, facilitating learning and memory formation. Evidence to the importance of acetylcholine in memory function, is seen in the association of acetylcholine deficiency or cholinergic neuronal destruction with Alzheimer's disease, dementia and memory loss.

Alzheimer's disease has been strongly associated with a deficiency of the neurotransmitter acetylcholine and degeneration of acetylcholine containing neurons. Therapies that help restore acetylcholine levels have been shown to provide some benefit to the symptoms of Alzheimer's disease. Studies show improvement in processes such as memory and learning from acetyl-l-carnitine supplementation. ALC supplementation to patients with Alzheimer's disease have generally shown improvements in special learning tasks, timed tasks of attention, discrimination learning tasks and tasks of personal recognition.[3][4][5]

Acetyl-l-carnitine and Acetylcholine production

Acetylcholine is synthesised from the precursors choline and acetyl-CoA, a reaction that is catalysed by the enzyme choline acetyltransferase. Co-factors that support this reaction are pantothenic acid (vitamin B5), a component of coenzyme A, and thiamine (vitamin B1), which encourages presynaptic release of acetylcholine.

Acetyl-l-carnitine has also been shown to be beneficial in this reaction by:
- contributing its acetyl group for the production of acetyl-CoA
- facilitating the uptake of acetyl-CoA into the mitochondria
- increasing the activity of choline acetyltransferase in the CNS
- preventing loss of choline acetyltransferase activity

ALC may also exert cholinomimetic effects, which have been hypothesised to be attributed to the blocking of post-synaptic inhibition potentials[6] or direct stimulation of the synapses.

Supplementation of acetyl-l-carnitine together with precursor and co-factor nutrients such as choline, vitamins B1 and B5 may assist in the up-regulation of acetylcholine production.

References
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