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The effects and mechanisms of mitochondrial nutrient alpha-lipoic acid on improving age-associated mitochondrial and cognitive dysfunction: an overview.

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Abstract

We have identified a group of nutrients that can directly or indirectly protect mitochondria from oxidative damage and improve mitochondrial function and named them "mitochondrial nutrients". The direct protection includes preventing the generation of oxidants, scavenging free radicals or inhibiting oxidant reactivity, and elevating cofactors of defective mitochondrial enzymes with increased Michaelis-Menten constant to stimulate enzyme activity, and also protect enzymes from further oxidation, and the indirect protection includes repairing oxidative damage by enhancing antioxidant defense systems either through activation of phase 2 enzymes or through increase in mitochondrial biogenesis. In this review, we take alpha-lipoic acid (LA) as an example of mitochondrial nutrients by summarizing the protective effects and possible mechanisms of LA and its derivatives on age-associated cognitive and mitochondrial dysfunction of the brain. LA and its derivatives improve the age-associated decline of memory, improve mitochondrial structure and function, inhibit the age-associated increase of oxidative damage, elevate the levels of antioxidants, and restore the activity of key enzymes. In addition, co-administration of LA with other mitochondrial nutrients, such as acetyl-L: -carnitine and coenzyme Q10, appears more effective in improving cognitive dysfunction and reducing oxidative mitochondrial dysfunction. Therefore, administering mitochondrial nutrients, such as LA and its derivatives in combination with other mitochondrial nutrients to aged people and patients suffering from neurodegenerative diseases, may be an effective strategy for improving mitochondrial and cognitive dysfunction.

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