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Feeding mitochondria: Potential role of nutritional components to improve critical illness convalescence

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Abstract

Persistent physical impairment is frequently encountered after critical illness. Recent data point towards mitochondrial dysfunction as an important determinant of this phenomenon. This narrative review provides a comprehensive overview of the present knowledge of mitochondrial function during and after critical illness and the role and potential therapeutic applications of specific micronutrients to restore mitochondrial function. Increased lactate levels and decreased mitochondrial ATP-production are common findings during critical illness and considered to be associated with decreased activity of muscle mitochondrial complexes in the electron transfer system. Adequate nutrient levels are essential for mitochondrial function as several specific micronutrients play crucial roles in energy metabolism and ATP-production. We have addressed the role of B vitamins, ascorbic acid, α -tocopherol, selenium, zinc, coenzyme Q10, caffeine, melatonin, carnitine, nitrate, lipoic acid and taurine in mitochondrial function. B vitamins and lipoic acid are essential in the tricarboxylic acid cycle, while selenium, α -tocopherol, Coenzyme Q10, caffeine, and melatonin are suggested to boost the electron transfer system function. Carnitine is essential for fatty acid beta-oxidation. Selenium is involved in mitochondrial biogenesis. Notwithstanding the documented importance of several nutritional components for optimal mitochondrial function, at present, there are no studies providing directions for optimal requirements during or after critical illness although deficiencies of these specific micronutrients involved in mitochondrial metabolism are common. Considering the interplay between these specific micronutrients, future research should pay more attention to their combined supply to provide guidance for use in clinical practise. REVISION NUMBER: YCLNU-D-17-01092R2.

Keywords: ATP; Bio-energetic failure; Electron chain complex; Enzyme Q10; Melatonin; Micronutrients.

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