Extra virgin olive oil consumption modulate mitochondrial function in high fat-fed mice: potential role of nitro fatty acids

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Extra virgin olive oil (EVOO) represents the main source of unsaturated lipids in the Mediterranean diet associated with cardioprotection and low mortality. Electrophilic lipid nitroalkenes (NO2-FA) have pleiotropic anti-inflammatory cell signaling responses in mammals. We postulate that NO2-FA could modulate mitochondrial gene expression and metabolic responses, contributing to the health benefits associated with the Mediterranean diet. Recent data showed the endogenous presence of nitrated conjugated linoleic acid (NO2-cLA) in extra virgin olive oil (EVOO) as well as nitro-linoleic (NO2-LA) and nitro-oleic acid (NO2-OA) under gastric acidic nitrations conditions. Herein, we evaluate if EVOO supplementation in mice under high fat diet favors NO2-FA formation, thus modulating mitochondrial function. High fat-fed mice supplemented with EVOO plus nitrite exhibited a low increase in body weight than controls, in addition to a decrease accumulation of fat in liver. Mitochondrial function was analyzed by high resolution respirometry in heart and kidney. High fat diet mice exhibited a decrease in RCR, with the EVOO plus nitrite condition improved mitochondrial function. Moreover, in the presence of EVOO plus nitrite the RCR was higher in mice under high fat diet than those without EVOO supplementation (p<0.05). When looking for respiratory chain mitochondrial activities, succinate dehydrogenase and ATPase were significantly improved in the EVOO supplementation condition. In addition, tissue lipid oxidation, protein nitration and carbonyls formation were lower in EVOOsupplemented animals, being greater when nitrite was present. As part of the antioxidant/anti - inflammatory actions of nitroalkenes, liver hemoxygenase-1 (HO-1) expression was increased by EVOO supplementation, concomitant with down-regulation of nitric oxide synthase-2 (NOS2). Plasma levels of NO2-FA increased in the EVOO/nitrite conditions, suggesting an association between NO2-FA formation by EVOO and an improvement in mitochondrial function.

Keywords: Extra virgin olive oil, nitro fatty acids, mitochondrial function.