The Effect of Fatty Acids on Mitochondrial Metabolism of the Neuronal and Glial Cell Lines.

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Fatty acids (FAs) supplied with diet are high energy substrates which act both as source of energy as well as regulators of metabolic processes in health and in stress condition. **The aim of the study was assessment of the modulatory effects of different fatty acids (FAs) on energy metabolism and mitochondrial function in brain-derived cells.** The LN-18 (CRL-2610; ATCC) - human glioblastoma cells derived from a temporal lobe , HCN-1A (CRL-10442; ATCC) - human cortical neurons, Daoy (HTB-186; ATCC) - human medulloblastoma cells derived from a cerebellum and mice astrocytes C8-D1A (CRL-2541, ATCC) cells were challenged with stressors such as TNF-□, staurosporine (STS) and beta-amyloid (B-amyloid) and incubated with fatty acids palmitic acid (PA), oleic acid (OA), arachidonic acid (AA), eicosapentaenoic acid (EPA) and tetradecylthioacetic acid (TTA). The cells were treated with these compounds for 24 h and then challenged with beta-amyloid (25 μM, added after 6 h) for 18 h before the fuel handling measurements. Mitochondrial metabolism was assessed by fatty acid and glucose uptake, changes in mitochondrial membrane potential, ATP generation, mitochondrial respiration and apoptosis, DNA damage, and calcium flux (end-point analysis by flow cytometry and in vivo monitoring by confocal microscopy); mitochondrial metabolic potential (the mitochondrial oxygen production rates) by an OROBOROS® Oxygraph.

In general fatty acids promote increased FA oxidation and decreased glucose utilization in brain derived cells. Restoration of membrane potential after incubation with different fatty acids in stressed cells were also observed. Mitochondrial respiration seems to be not affected by FAs. Opposite effect of PA (decrease) and TTA (increase) were observed in ATP generation in LN18 cells. The overall effects of FA treatments demonstrated difference between the various FAs and cells examined. Some FAs such as EPA and TTA can modify the stressor response to STS or beta-amyloid. There are new insights into the potential mechanisms for the neuroprotective actions of unsaturated fatty acids.

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