Polyunsaturated fatty acid supplementation stimulates differentiation of oligodendroglia cells (and myelin repair)


Abstract

Dietary polyunsaturated fatty acids (PUFAs) have been postulated as alternative supportive treatment for multiple sclerosis, since they may promote myelin repair. We set out to study the effect of supplementation with n-3 and n-6 PUFAs on OLN-93 oligodendroglia and rat primary oligodendrocyte differentiation in vitro. It appeared that OLN-93 cells actively incorporate and metabolise the supplemented PUFAs in their cell membrane. The effect of PUFAs on OLN-93 differentiation was further assessed by morphological and Western blot evaluation of markers of oligodendroglia differentiation: 2',3'-cyclic nucleotide 3'-phosphodiesterase (CNP), zonula occludens-1 (ZO-1) and myelin-associated glycoprotein (MAG). Supplementation of the OLN-93 cells with n-3 and n-6 PUFAs increased the degree of differentiation determined by morphological analysis. Moreover, CNP protein expression was significantly increased by gamma-linolenic acid (GLA, 18:3n-6) supplementation. In accordance with the OLN-93 results, studies with rat primary oligodendrocytes, a more advanced model of cell differentiation, showed GLA supplementation to promote oligodendrocyte differentiation. Following GLA supplementation, increased numbers of proteolipid protein (PLP)-positive oligodendrocytes and increased myelin sheet formation was observed during differentiation of primary oligodendrocytes. Moreover, increased CNP, and enhanced PLP and myelin basic protein expression were found after GLA administration. These studies provide support for the dietary supplementation of specific PUFAs to support oligodendrocyte differentiation and function.

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