Investigating the regulatory effect of omega-3 polyunsaturated fatty acid supplementation on the immune imbalance induced by crystalline silica ($cSiO_2$) in mice

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Outline

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Abstract

Systemic lupus erythematosus (SLE) is an autoimmune disease mediated by autoantibodies (AAb), characterized by disruption of immune tolerance and overactivation of B cells, leading to damage to organs. Recent studies have pointed out that eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in omega-3 polyunsaturated fatty acids (PUFAs), may have a regulatory effect on immune imbalance. In the first study, the authors used $cSiO_2$-induced NZBWF1 mice to simulate the onset of autoimmune diseases. The results showed that DHA intervention can inhibit the production of inflammatory cytokines and regulate the differentiation of B cells, and reduce the production of AAbs, indicating that omega-3 can delay the course of lupus. The second study focused on the acute pulmonary immune response after $cSiO_2$ exposure. High-dose DHA can effectively intervention inhibit the elevation of antibodies and downgrade the antigen presentation of inflammation-related pathways, thereby reducing lung inflammation and immune imbalance.

Combining the two studies, the protective effect of omega-3 is mainly by inhibit B cell differentiation and AAbs production, as well as control antigen-presenting cells (APCs) activation and inflammatory gene expression. These results show that omega-3 has potential nutritional adjuvant therapeutic value for autoimmune diseases.

Reference

Pestka, J. J., Akbari, P., Wierenga, K. A., Bates, M. A., Gilley, K. N., Wagner, J. G., Lewandowski, R.P., Rajasinghe, L.D., Chauhan, P.S., Lock, A.L., Li, Q.Z., & Harkema, J. R. (2021). Omega-3 polyunsaturated fatty acid intervention against established autoimmunity in a murine model of toxicant-triggered lupus. *Frontiers in immunology*, 12, 653464.

Chauhan, P. S., Benninghoff, A. D., Favor, O. K., Wagner, J. G., Lewandowski, R. P., Rajasinghe, L. D., Li, Q.Z., Harkema, J.R., & Pestka, J. J. (2024). Dietary docosahexaenoic acid supplementation inhibits acute pulmonary transcriptional and autoantibody responses to a single crystalline silica exposure in lupus-prone mice. *Frontiers in Immunology*, 15, 1275265.