

Omega-3 polyunsaturated fatty acid and preterm birth

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Objective:

Omega-3 polyunsaturated fatty acid (PUFAs) including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) have anti-inflammatory effects, whereas omega-6 PUFAs such as arachidonic acid (AA) have pro-inflammatory effects. Preterm birth is an important obstetrical complication and one of its main causes is known to be an inflammation. The objective of this study is to clarify the efficacy of food intake of omega-3 and -6 PUFAs to preterm birth and then to test the preventive efficacy of omega-3 PUFAs against preterm birth and to clarify its mechanism.

Methods:

We performed dietary survey for third trimester pregnant women using Brief-type self-administered Diet History Questionnaire (BDHQ) and calculated the amount of intake ratio of EPA (omega-3) and arachidonic acid (omega-6). We also measured serum fatty acid concentration ratio (EPA/AA) and evaluated prognosis of pregnancy. For basic analysis, we performed the experiments with fat-1 mice, capable of converting omega-6 to omega-3 PUFAs. We identified the candidate agent for preterm birth by comprehensive metabolomic assessments of lipid metabolites and tested the preventive effect of the metabolites.

Results and Conclusions:

EPA/AA intake ratio positively correlated to serum EPA/AA concentration ratio and women with preterm birth took less omega-3 fatty acid than those with term birth. Abundance of omega-3 PUFAs in fat-1 mice reduced the incidence of preterm birth induced by lipopolysaccharide (LPS) and inflammation was reduced in fat-1 mice. The analyses of lipid metabolomics showed high level of 18-hydroxyeicosapentaenoate in fat-1 mice, which was derived from EPA and was metabolized to anti-inflammatory product named resolvin E3 (RvE3). The administration of RvE3 to LPS-exposed pregnant wild type mice decreased the incidence of preterm birth. Our data suggest that RvE3 could be a potential new therapeutic for the prevention of preterm birth.

(Ref: Yamashita A, et al. Sci Rep 2013; 3: 3113.)

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