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Effect of omega-3 fatty acid on mitochondrial membrane and erythrocyte membrane fatty acid in adenine induced uremic rats

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Objectives: The kidney has the second highest mitochondrial content in the human body. Fatty acids (FAs) are one of the important energy sources and main constituents of cell membranes. Higher erythrocyte membrane oleic acid contents are related to acute coronary syndrome and omega-3 FA can reduce oleic acid contents. We investigated whether omega-3 FA modifies not only erythrocyte membrane FA but also mitochondrial membrane FA of kidney in adenine-induced uremic rats.

Methods: Male Sprague-Dawley rats were fed diets containing 0.75% adenine and 2.5% protein for three weeks. Next, rats were randomly divided into six groups that were fed diets containing 2.5% protein and saline or omega-3 FAs were supplemented by gastric gavage for four weeks: normal control (0.9% saline, n=7), adenine control sacrified at 3 weeks (0.9% saline, n=6), adenine control sacrified at 5 weeks (n=5), adenine control sacrified at 7 weeks (n=5), omega-3 FA group sacrified at 5 weeks (300 mg/kg/day, n=5) and omega-3 FA group sacrified at 7 weeks (n=5). The mitochondrial isolation membrane was used for renal mitochondria extraction. The mitochondrial and erythrocyte membrane FA contents were measured using gas chromatography.

Results: Compared with normal control group, serum creatinine levels in adenine control group was significantly increased and improved in omega-3 FA group. Compared with adenine controls, erythrocyte and mitochondrial monounsaturated FA contents including oleic acid and arachidonic acid (AA) levels were significntly decreased in omega-3 FA group. FA compositions were similar between erythrocyte and mitochondrial membranes in each group. Monounsaturated FA contents including oleic acid, and eicosapentaenoic acid were higher and saturated FA was lower in mitochondrial membrane than in erythrocyte membrane of adenine controls.

Conclusions: Omega-3 FA affects not only erythrocyte membrane FA but also mitochondrial membrane FA in uremic rats. Erythrocyte membrane FA contents can reflect mitochondrial membrane FA contents of the kidney.