

Effect of omega-3 fatty acid on mitochondrial biogenesis and dynamics of heart in uremic rats

동아대학교병원 내과¹

박빈나¹, 이수미¹, 안원석¹

Background/Aims: Mitochondrial biogenesis and dynamics are related with cardiac and renal dysfunction. Dynamin-related protein-1 (DRP-1)-dependent mitochondrial fission is cardioprotective but is activated in AKI. We aimed to investigate whether omega-3 fatty acid (FA) regulate the expression of mediators of mitochondrial biogenesis and dynamics in kidney and heart of adenine induced uremic rats.

Methods: Male Sprague-Dawley rats were fed diets containing 0.75% adenine and 2.5% protein for three weeks. Rats were randomly divided into three groups: normal control, adenine control, and omega-3 FAs group (300 mg/kg/day were supplemented for next four weeks). The renal and cardiac expression of PGC-1 α , SIRT1/3, Nrf2, DRP-1, optic atrophy 1 (OPA1), PTEN-induced putative kinase 1 (PINK1), protein-interacting protein 3 (BNIP3) and the Nip3-like protein X (NIX) were examined by western blot analysis. The qPCR was used to determine relative content of mitochondrial DNA (mtDNA).

Results: Compared to the normal, serum creatinine and heart weight/body weight in adenine control was significantly increased and improved in omega-3 FA group. Compared with normal, PGC-1 α , SIRT1/3 and Nrf2 were significantly down-regulated in kidney and heart of adenine control but only SIRT1 of heart was significantly recovered in omega-3 FA group. DRP-1 was significantly up-regulated and OPA1 was down-regulated in kidney of adenine control but was not mitigated in omega-3 FA group. Both DRP-1 and OPA1 were significantly down-regulated in heart of adenine control and DRP1 was significantly recovered in omega-3 FA group compared to normal. PINK1, BNIP3 and NIX related with mitophagy were significantly down-regulated in heart of adenine control and those were significantly recovered in omega-3 FA group. Compared to the normal, mtDNA was decreased in kidney and heart of adenine control group but mtDNA of heart was recovered in omega-3 FA group.

Conclusions: DRP-1 was reversely expressed in kidney and heart of uremic rats. Omega-3 FA improved mitochondrial biogenesis and dynamics of heart by up-regulating molecules associated with mitochondrial fission and mitophagy in uremic rats.